This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

IS·BOOK·BELONGS·TO
Hawkes

Pat Dunn

Salvaterr

STANFORD UNIVERSITY LIBRARY

Gift of

Appointment Office

100 .

THE PHILOSOPHY OF THINGS

COMPLETE IN TWO BOOKS

ISSUED IN ONE OR IN TWO VOLUMES

BOOK ONE
THE PHYSICAL UNIVERSE

BY JAMES FERGUSON

STANFORD LIBRARY

DENVER COLORADO U. S. A.
EDITED AND PUBLISHED BY THE AUTHOR
TRADE ADDRESS
"PHILOSOPHY OF THINGS"
1843-45 CURTIS STREET
1922

C 99.9
F352

649659

COPYRIGHT, 1922,
BY JAMES FERGUSON.

SET UP, ELECTRO-PLATED, PRINTED AND BOUND, by the author
IN DENVER COLORADO U. S. A.

—PREFACE—

TO BOOK ONE, THE PHYSICAL UNIVERSE

The principal datum upon which this system is built was obtained from the old school books on Natural Philosophy, by David A. Wells and G. P. Quackenbos, published in 1857 and 1859. Later I read a few other books best among them being Youman's "Conservation of Forces" and Spencer's "First Principles." About this time (1877) I commenced writing on the subject of philosophy and my first effort was to explain the cause of Gravitation. The general theories worked out during the few years following that time, and which apply to gravitation, electric attraction and repulsion, molecular attraction and repulsion, (as in chemical changes) magnetic attraction and repulsion, the phenomena of the tides, comets, sun-spots and the universe as a whole, were published in 1899; now out of print. All of these theories, with copious additions, are reproduced in this book.

All but the last two chapters of this book were rewritten for the last time, prior to 1904. A brief review of the progress of philosophy since that time, seems necessary to a complete understanding of the contents of this book. But I must make it brief for a thorough review cannot be attempted here.

From the beginning it seems that the various systems of Idealism, subjective and objective, which deny the existence of things apart from mind, Realism or Naturalism, which contends for the reality of a world of matter, motion, mind, external to the conscious individual, and Scepticism or Agnosticism, which contends that not only the above named but all systems of philosophy are more or less doubtful, have covered the whole of the proper sphere of philosophy.

Early in my speculations I reached the idea that there must be a good reason for scepticism; and I thought I had found it in idealism. Subjective idealism assumes that all things are in the conscious mind and that they exist only when we are conscious. Objective idealism teaches that all things are ideas created by

God and existing independent of us; but we can absorb them. I gradually came to the idea that there was no truth in subjective idealism but there might be some truth in objective idealism. God makes things but He does not make our ideas about things. We make them ourselves and what we make depends on how we think. If we commit sin or act the fool we cannot blame God for it and so escape the responsibility of wrong doing. This form of idealism would give us a real basis for a science of morality, so I adopted it with the proviso that realism or naturalism, in short, all knowledge can be nothing in itself but a system of ideas in the mind, and the question for us to decide is, what is the true idealism? When we find the answer to this question, I believe scepticism will be routed from this planet.

I very soon reached the conclusion that ordinary judgment or common sense was the only mode of procedure in the quest for real knowledge, for me at least, and that good judgment must depend on knowledge of real things. The first step in philosophy, as I then thought and still think, is an answer to the questions, what are space, time, matter, motion, mind? (§ 1) If nature is one complete and perfect whole, it must have a set of laws or conditions of existence—a system of first and fundamental truths on which to rest and hold together. So far in philosophy it seemed clear that no such system had yet emerged but at the present time (1922) it may be best to mention here what other prominent writers have said about this question of ultimate truths. The following has appeared subsequent to 1899.

In his book "A Theory of Reality," 1899, George T. Ladd, Professor of philosophy in Yale University, says:

"But is space properly spoken of as though it was an active principle? To this question scientific psychology gives no hesitating or equivocal answer. It demonstrates beyond doubt that, considered from the psychological point of view, space is most properly and precisely just that. It attains its highest development in that systematic doctrine of spatial qualities and spatial relations which the physical sciences so successfully employ."

In another place he says: "Time and space are thus regarded in the light of universal "media." Things, with all that they really are and all that belong to them, are in these media."

PREFACE TO BOOK ONE, PAGE III

The exact meaning of the word "media," is not clear to me and the dictionaries do not explain. But if no one can tell us what space or time is we cannot expect anything definite.

Ralph B. Perry, Professor of philosophy in Harvard University, says in his "Present Philosophical Tendencies" 1916.

"The critique of science which has just been examined might be termed a methodological critique, as distinguished from the metaphysical critique to which we must now turn. According to this critique, science has to do with appearance or phenomenon rather than reality, because of the nature of its basal concepts, space and time. These concepts are inherently contradictory or lacking in self-sufficiency; and physical nature as the realm of space and time, must be supposed to be in the end resolved into something else. They must be corrected, or overcome, in some higher unity as evil is held to be transmuted into good in the providence of God."

He finds this critique in Immanuel Kant. According to Kant space and time are vitiated by antinomies. "This means that on the supposition of the reality of space and time, it is possible to prove with equal certainty, several contradictory pairs of thesis and counter thesis; such as that space has boundaries and has not, time has a beginning and has not, space and time have indivisible elements and have not, etc. The moral according to Kant, is that we must repeat the original supposition, and deny the reality of space and time."

E. G. Spaulding Professor of Philosophy in Princeton University, in his "New Rationalism" 1918, says:

"Space like time is an organized whole or relational complex that consists of several kinds of parts, and that has various characteristics. It consists of dimensions, such as lines, planes and volumes. Any finite space consists of smaller spaces; that is, lines as finite, consist of smaller lines, planes, of smaller planes, and volumes, of smaller volumes."

"Space, Time and Deity," is the title of a large and said to be a very important contribution to systematic philosophy in two volumes, 1920, by S. Alexander M.A., LL.D., F.B.A. HON. Fellow of Lincoln College Oxford, Professor of Philosophy in the University of Manchester England.

PREFACE TO BOOK ONE, PAGE IV

The first sentence in chapter one, volume one, of this work reads as follows: "It is not, I believe, too much to say that all the vital problems of philosophy depend for their solution on the solution of the problem what Space and Time are and more particularly how they are related to each other."

This is my own view exactly, but I have included Matter, Motion, Mind, in the first category. (First three chap. Book 1.)

He treats space and time empirically, describing and analysing them and considering their connections, if any, as we do other realities. He does not ask whether they are real in themselves or not but assumes that they are and asks what that reality is. To understand how space and time are related to each other he considers the matter in these words:

Page 44. "Other features will declare themselves as we proceed, some obvious, some less so. But they will be found to require for their understanding the understanding of how Space and Time are related to each other. These are often thought, perhaps commonly, to be independent and separate (whether treated as entities as here or as systems of relations). But a little reflective consideration is suffiicent to show that they are interdependent, so that there neither is Space without Time nor Time without Space; any more than life exists without a body or a body which can function as a living body exists without life; that Space is in its very nature temporal and Time spatial."

Then follows a long and most elaborate discussion, all of which aims to show that space and time are not separate things but one thing—the one and the only whole thing; the primordial "stuff or matrix out of which things and events are made."

The author says page 60: "Meantime, I may proceed with the metaphysical exposition. We have then to think of Space and Time in much the following way. (a) By themselves each consists of elements or parts which are indistinguishable so long as the elements of the other are excluded. (b) In reality each point of space is determined and distinguished by its instant in time, and each instant of time by its position in space. The elements of the one reality which is Space-Time, and not either Space or Time alone, owe their distinctness in either kind to the complementary element."

PREFACE TO BOOK ONE, PAGE V

The reader may be able to understand the meaning of the three passages quoted above, but for me and in view of what follows they are a little hazy. On p.p. 340-341 he says:

"We are describing the infinite Space-Time as the substance which includes all substances and is the system of them. But the idea of infinity is prior to that of an infinite system of existents, which is really derived from it. * In truth, infinite Space-Time is not the substance of substances, but it is the stuff of substances. * Just as a roll of cloth is the stuff of which coats are made but is not itself a coat, so Space-Time is the stuff of which all things, whether as substances or under any category, are made. If I call it the stuff and not the material, it is to avoid confusion with the very much more specific idea of matter, as matter is commonly understood. Matter is a finite complex of space-time with the material quality, as we shall see later."

From the three passages quoted above I get the following by way of understanding. The universe, or all the categories of things, viewed collectively, is primarily a composite of points of space, and instants of time, determined and distinguished by their interdependent relationship. And these space-time elements are substantial entities. This, from my point of view, is very plainly an unwarranted confusion of the space-matter or nothing-something relation. The idea that an instant of time can be a substantial entity, or a point of space can be necessary to the continuation of time, or that these space-time elements can be distinguished and known as such yet be space-time itself, is beyond my range of thought. These space-time elements to be thinkable must be things and to be things they must have the regular background of difference—the one essential to the very existence of things and thought.

In the last passage quoted above this author plainly reveals the fact that he regards the universe as a compound, or perhaps more correctly speaking, a complex of different substances. A stuff is not a substance and what we call matter is neither stuff nor substance. Matter is something which has the material qualities, which stuff or substance has not.

How he has managed to make these distinctions in matter is not revealed and how far he has succeeded in working out a system of real things within his space-time fundamental, is also not evident. But from what follows it appears that he has not yet reached a systematic arrangement of all things, which explains the mysteries about them, as required by philosophy.

Page 336: "Space-Time is thus the source of the categories, the nonempirical characters of existent things, which those things possess because of certain fundamental features of any piece of Space-Time. These fundamental features cannot be defined. For to define is to explain the nature of something in terms of other and in general simpler things, themselves existents. But there is nothing simpler than Space-Time, and nothing beside it to which it might be compared by way of agreement or contrast. They cannot even be described completely. For description like definition, is effected by reference to existent entities."

He thus ends in the inexplicable, as did Spencer and all the philosophers prior to this date. This at least is the result reached at the end of volume one, 347 pages. I have not yet seen volume two, but from a review of the whole by Professor Leighton of the Ohio State University I get the following:

"If time were bare time it would consist of perishing instants. Instead of a continuous time there would be nothing more than an instant, a now which was perpetually being renewed. Time would then be for itself and for an observer a mere now, and would contain neither earlier or later. * In order that time should linger, space must recur, a point must be repeated in more than one instant. * Space is generated in or by time. Space is the trail of time. Time is the occupation of a stretch of space. Space-Time consists of lines of advance connected into a whole or system, a system of motions. * The history of the universe is a continuous redistribution of instants of time among points of space." (The Philosophical Review for May 1921.)

Professor Leighton's review (a small part of which is reproduced above) gives us a more specific account of the inner nature of Professor Alexander's Space-Time. This, I suppose, will be sufficient to give the reader a very correct idea of this work, which is now said to be the latest, most complete, and most authoritative work in philosophy. Every studemt of philosophy should examine this work. It may help him to a better understanding of the real nature of things. At least it will be a good example of present philosophical tendencies and it may forecast a change to the interest of progress. It will be noticed that all the writers above quoted have offered no definite conclusion as to what space or time really are in themselves, except Professor Alexander; and he has failed to define his ultimate because he cannot find a suitable correlative. There is nothing beyond or deeper than his space-time ultimate.

Now, in as few words as possible I will try to make it plain why, not only this writer but all the others, have failed to touch bottom in philosophy. They have ignored or overlooked what I have called the most important distinction in philosophy—the Space-Matter or Nothing-Something relation. (Chapter First.)

The question "what are things," may truly be regarded as the first and most fundamental of all questions. Every thing, actual, ideal or relative, must be regarded as a thing and that which is not a thing must be nothing. The true philosophy must be a science of the whole, just as Astronomy, Physics, Chemistry, Psychology, Biology and Sociology, are sciences of the parts. It should be (1), a definition of things, (2), a primary classification of things, (3), an explanation of the true relations and systematic arrangement of things, as would be required and understood by the ordinary common sense of mankind. This at least, is the view which appeals to my understanding and I believe it will be fully justified in the pages of this book.

Here I will repeat my definition of things along with a first classification of things, and some further comments which do not appear in the text. By bringing this matter in at this place the reader can readily compare my views with those of the others quoted above on this question of the ultimate nature of things, or what time and space are in themselves.

There is nothing but things and nothing, and even nothing must be something if we can think of it. Every thing is a thing for three simple reasons: (1), By reason of its Difference from other things and nothing. (2), By reason of its Relations to other things and nothing. (3), Because there is a space occupying Substance, (properly called matter,) in which it was necessary to create difference in order to create things.

PREFACE TO BOOK ONE, PAGE VIII

Here I am offering a fundamental classification of things.

All things belong to two classes: (1), Real things: (2), Relative things. Real things are all contained in the space occupying substance which we call matter. Relative things are what we have named Space, Time, Differences, Relations, Mathematics and its branches. Relative things differ only in their relations to real things; in themselves they are nothing—the only nothing we can think of, yet they are thinkable and so must be something; but they are something only in the relative sense.

In itself, space is a relative something—a necessary condition to the existence of real things. Whatever exists must be in space because there is no out of space. In its relations to real things space is nothing—not something as matter, motion or mind is. We can think of an unlimited empty space and being thinkable space must be an object of thought and must be regarded as a relative thing simply because it would not be anything at all if out of all relations to that which occupies space. This is likewise true of Time, Differences, Relations, Mathematics and all of its branches. Time is simply the duration or past, present and future of real things. Without the real things there would be nothing enduring and of course no time. The idea that bare time consists of perishing instants can be reconciled only with the idea that time is a substantial entity. The form of a substance may perish by a change of form; but nothing cannot perish. The true relationship of time, space, and real things is thus made to stand clearly in view.

Without real things relative things would not be known because mind is a necessary part of the reality. But relative things would exist without real things because they are the laws, principles or conditions indispensable to the existence of real things; the fundamental truths upon which the true system must rest. They are the rules or means of measuring or estimating the dimensions, numbers, forms, and relations, of real things, but they are not the real things. We can measure the distance between two objects in space but we cannot measure space. When we measure the interval between two events in time we do not measure time, but we do measure the uniform motion of inert matter—the axial motion of the earth. Two added to two make nothing, but two real things added to two real things, make four real things. A material circle is a real thing, the form of a circle is a relative thing. Laws of Nature are not Nature.

What is nothing? This is another hard question, which, it seems has never been answered. So far as I can learn here is the first answer in human history.

In itself, nothing is something. It is a necessary condition to the existence and knowledge of real things. It is only in the difference and contrast of nothing-something, that any real thing can exist or can be known. An universal nothing would be a boundless empty space with no real thing in it, and this, of course is unthinkable, simply because there would be no one to do the thinking. But in the view of a thinking being, nothing may be a rational possibility or a relative thing.

In its relations to real things, nothing is nothing—not something as matter, motion or mind is—yet it may be known as a relative thing. So it comes to this: Nothing is empty space and empty space is a relative thing.

Since the human mind has never known what space or nothing is, we have no appropriate word for the expression of an absolute non-existence or a real nothing. The words 'real and relative' may seem inappropriate but what would be better? An absolute nothing would have to be, in itself, a state of being in which there is no space; and this of course would be a rational impossibility. So it follows that empty space, though relatively thinkable, is the only nothing that the human mind can think of.

It is not impossible to see that the same conclusion will apply to all the relative things. All are abstract truths which have no meaning if not viewed in some relation to real things. No real thing can exist without time and space in which to exist. Without difference in something real there are no real things. Without real things there are no real relations of things. The true principle of relativity is a branch of mathematics. The first step in the practical use of any branch of mathematics requires some knowledge of some form or complex of real things. We cannot figure on relative things. One of the great mistakes of modern science is in the very general belief that a thorough mathematical training is a needed qualification for physical research work. The mistakes of Prof. Einstein and his followers are discussed in the appendix to this book. It is there shown that they have all ignored or overlooked this very important distinction among things. It seems to be a very general belief that space and time have dimensions like material things. Space is supposed to have three dimensions; length, breadth and thickness. According to Einstein space and time are the same thing and it has four dimensions. It also has different lines of direction in different places and even in some places space-time is warped or curved exactly as we might expect of material lines.

It is a striking fact that all the writers so far concerned in the literature of Einstein and his followers, have used exactly the same language that we all use when writing or speaking of real things, as above defined. Nowhere can we find a word to show that any one has ever thought of making this distinction among things. Now the question: Is this view sound or justified by science and facts? Is it not true that if this definition and classification of things proves to be scientifically incontestable, that it must furnish the foundation for a complete and perfect SYSTEM OF SCIENTIFIC PHILOSOPHY?

In a system like this we would have the well known and well recognized fundamental laws or conditions above named as relative things and which are necessary to the existence of anything.

On the Physical side of real things we would have the forms and states of Matter and Motion, with Inertia as their governing law and which would be the basis of the Physical Universe.

On the Mental side of real things we would have the forms and states of Mind, which, under the laws that govern the conscious Mind would form the basis of the Mental Universe.

With a limited physical universe and an atomic ether medium governed by physical laws as described in this book all the mysteries known to physical science may be in fact are explained. Principal among these mysteries are: the cause of gravitation or falling motion, the cause of electric and magnetic attraction and repulsion, the cause of chemical or molecular attraction and repulsion, the cause of the repulsive action of the sun on the tails of comets while in perihelio, the mystery of the tides and many minor mysteries; and all are explained and united under the well known laws of motion which govern the movements of inert matter. If this theoretical notion can stand the scrutiny of exact science it will be the most sweeping generalization ever offered to the world.

While setting up the last pages of this preface another new book on philosophy has come to my notice. Its title is:

"The New Idealism," by May Sinclair, London and New York, 1922. The aim of this work is to examine the foundation of realism more critically, and to outline a reconstruction of idealism more closely than was possible five years ago.

The writer says in part: "Realism is ten times more formidable than it was in 1917. * The issue has been narrowed down to the field of Space and Time, and it is there that the battle between realism and idealism must be fought. The issue is very clear. For however realists may differ among themselves, whether they say with Professor Alexander that Space-Time is the ultimate reality, or with Professor Whitehead that the ultimate entities are events, they are all agreed that mind is not the ultimate entity and must be kept out of the problem."

This writer makes a stromg plea for mind as one of the ultimates. She says: "Mind on any realist scheme, is only one more entity, one more change in a sequence of changes; the last thing, not the first, though highest, if you like, in value."

The realists are trying to account for mind as part of a system in which mind was not present from the beginning. Space-Time point instants, do not think. This authoress maintains that consciousness is ultimate, that there is primary and secondary consciousness and that the assumption of realism (that in the act of knowing we know that things exist in themselves apart from the knowing mind) is not justified by the new idealism.

The aim of this authoress seems to be for an improved form of objective idealism, which recognizes an external reality; but whether the external world is purely mental or partly physical is not yet clear to me; in fact, all these discussions and disputes between realism and idealism have proved to be exceedingly confusing and much of it is incomprehensible to my mind. They all look to me like attempts to build a system of ideas which have failed to reach the real object in philosophy. The trouble must be in the point of view, in mine at least. How a point-instant of space-time, can be a real thing, yet not a space-time occupant, but space-time itself, is for me the best example of an impossibility that I can think of. This from my view point.

My views on this subject were not altgether acquired from books or education and I have absolutely no reason to think that they were a result of inspiration from on high. In early life I read but few books because I did not have them to read and I accepted as true only that which seemed to agree with a certain sense of right or innate judgment, which, so far as I could see, was always in me—simply natural. In 1863, at the age of 18, I hiked myself to the plains of western Kansas and Colorado and here, while rusticating close to nature, I got my point of view. This of course is not the college way and I suppose this is why so many college men do not agree with me.

Here I will reproduce an exact copy of my original point of view, which was put in writing at least 40 years ago. I quote from my first book; set up and copyright issued in 1895. Published in 1899. First edition 100 copies; 18 copies sold; 61 copies sent to news papers and magazines; 21 copies still on hand.

None of the scientific or philosophic publications paid any attention to it and the few news-papers that took some notice of the book did not seem to understand it. Here is my original and still commanding view point. I cannot get away from it.

"An universal likeness (no difference) can be thought of only as a boundless nothing—or as pure empty space. Empty space does not contain any thing, and in itself it is nothing; at least it is the best example of nothing the human mind can have. It is possible to think of space in contrast with something, and so it may be regarded as an object of thought; but when considered in the strictly abstract sense (as separated from something) we cannot think of it as being something. Deeper than this deepest contrast of nothing-something, mind cannot go, and this is the limit and foundation of all knowledge.

"This contrast, or difference of nothing-something, is also an irrevocable condition to existence. In the universal likeness of pure space there is no difference, and in the entire absence of difference there are no things. Difference, therefore, is the first law of existence. Space being everywhere, that which exists must exist in space, and must be limited as space is unlimited. That which exists in or occupies space is called Matter. As to what matter is, the testimony of common sense can be relied upon with perfect safety, since we can only think of it as a space relation, differing from space, limited in space and as having form and motion in formless and motionless space. Matter being the only space relation is therefore the sole foundation of being. The universe (all things) must exist in matter and by reason of difference. Outside of matter is empty space or nothing, and in nothing there is no difference. The word "things" is said to be the widest in our language and it is wide enough to take in all but nothing. It is only things that can exist, and each and every thing, in order to exist, must differ from nothing and from other things. Mind can know only things and nothing, and each and every thing, in order to be known, must be distinguished from nothing and from other things, through a sense of their difference. Difference, therefore, is also the first law of sense and of knowledge. This, in brief, is Universal Relativity: the law of all laws, because it precedes and includes all things. Though recognized by Hobbes, Hamilton, Mansel, Bain, Spencer, Condillac, and others, it seems to me that this important principle has never been duly appreciated, or applied as far as it will go. Feeling convinced that this is the primary law, that there is nothing deeper, and that there is no limit to its application until we reach the limits of the universe, I have adopted it as my sole guide throughout this work. I have even entertained the idea that this law is the key to all knowledge. To define anything, is to distinguish and described, all its differences and relations. When we have done this we then know that thing.

All differences in matter (things) admit of a primary classification as follows:

A. Difference of Kind: (1) matter itself, (2) the motion of matter, (3) the mind of matter. These three, Matter, Motion, Mind, are entities: they cannot be created, destroyed or changed into anything else.

B. Difference of State: (1) states of rest and states of motion in matter (on the physical side), (2) states of unconsciousness and states of consciousness in mind (on the mental side). The opposite states of matter are changeable into each other; so also are the opposite states of mind.

C. Difference of Form: (1) forms of matter and forms of motion on the physical side (changeable); (2) forms of memory and forms of consciousness on the mental side (changeable).

All matter is Inert when it is not conscious, and when it is conscious it is not inert. The inertia of matter with its laws of motion, is the first principle which governs the Physical Side of the Universe. There is nothing in physical nature but forms of inert matter and forms of physically guided motion. All physical activities or so called forms of energy, as sound, heat, light, electricity, magnetism, chemical action and sensible motion, are but forms of the motion of inert matter, which motion persists because matter is inert.

The ability of matter to be conscious is what we call Mind. Mind is a property of all matter and the conscious mind is the only free agent or real energy in the universe. When matter or its mind is conscious it is not inert, and so may control its own motion as in ordinary conduct. From which it follows that all energy or power must come from the Mental Universe, which, to our present physical sense is unseen.

This, in brief was my original point of view and to this day I have not found a single reason to depart from it. In fact I believe I have made a number of important contributions to our knowledge the truth of which may be seen from this view point. A first definition of things, a first classification of things, a first classification of all forms of motion into physically guibed and mentally guided, a new theory of sense perception and the external world for this life and the next, a new theory of the personality of God and of our relations to Him, and a new theory of the future life; are among the most prominent of the aditions to our theoretical knowledge of the universe.

This preface is more extended than usual in order to include a brief notice of what other well know and credible authors and professors of philosophy have said on the subject of space and time; also to show just how I differ with them.

DENVER COLORADO DEC. 28th. 1922. J. F.

CONTENTS.

BOOK ONE.

THE PHYSICAL UNIVERSE.

The following is a general outline of the contents and object of this book. A like summary of book two will be found at the beginning of that book. Dealing with the same subject, the two books may be issued together under one cover, or separately. The first named form has the advantage of compactness.

CHAPTER I. PHILOSOPHY, PAST, PRESENT AND FUTURE.

§1. Introduction.—The sphere of philosophy. A definition of things and of knowledge. Science is the further development and application of ordinary Common Sense to things known. Philosophy is the theoretical science of the Universe; which, to reach its object must proceed on the same common sense and scientific method. A philosophy of things is an explanation of things in themselves—ultimate truths. The salvation of the human race a question of philosophy. The animal origin and present half-animal nature of man must become a part of our moral and religious teachings. The question of saving souls is purely a question of the transformation of the animal mind into the human mind. The first step in philosophy, is, a comprehensive answer to the questions:

"What are Space, Time, Matter, Motion, Mind?"

§2. page 10. Sophisticated Philosophy.—There are no words in our language strong enough to deservedly condemn those numerous and destructive forms of Idealism, wrongly called philosophy, and which persist in teaching that things ultimately, cannot be known. As long as this perverted philosophy prevails the world will have no Philosophy.

§3. Common Sense Philosophy.—Every living thing must begin its independent existence with some real knowledge of the external world, obtained in sense experience, and this, when thorough and practical for its purpose, is common sense. The further development of common sense leads to Applied Science. From applied science and thru Inductive Inference we gradually pass, by the same process, into Theoretical Science; and this leads directly into the True Philosophy, on which may rest all further developments of Sociology or Life's Problems.

§4, page 34. Political Philosophy.—Not only everything that lives from the simplest up to man, but Society itself, in so far as it conforms to the laws of association or mutual dependence, is a Mental Organism. The mental laws which govern this organization are the fundamental laws of life; and therefore the same for animal, man or society. In few words, Conscious Life is possible only in the Association of a number of Mental Elements or Individuals, Organized and Active, for the purpose of securing Agreeable Relations. To the extent that the mental elements or individuals are imperfect in themselves, and to the extent that they are deficient in the organization of their cooperative activities, to that extent they are in want of the agreeable relations which make life enjoyable.

§5, pags 41. Religious Philosophy.-True Religion is not a revelation from God. It begins here on Earth in the study of Mind and Matter. Our experience in this life with the rational inference which proceeds thereon, will be sufficient to give us all that's good in religion and life.

CHAPTER II. THE EXTERNAL WORLD.

§6, page 47. The First Thing Known.—The first thing known is the reality of Self-consciousnes. We know that we exist; but we do not know why and how we exist until we understand the true and necessary relationship of Time, Space, Matter, Motion, Mind. The knowledge of self is not relatively evident, but self-evident. All other knowledge is relatively evident and it must begin with these five objects. To understand self-existence is to know these five objects in their true relations all at once.

§7, page 49. The Law of Things.—This law is found in the Differences and Relations among things and between things and nothing. Existence is not things.

§8, page 51. The Law of Existence.—A study of the origin of language will reveal the nature of things in themselves.

§9, page 53. What Existence Is.—In the most comprehensive sense of the word existence is found only in Matter, Motion and Mind, and in their relations to Time and Space.

§10, page 57. Conditions of Existence.—A first condition to the existence of anything, is, that it must occupy time and space. Time and space in their relations to that which occupies time and space, are objects of thought; in themselves they are nothing. If we can think of enpty space we can think of nothing.

§11, page. 60. What Philosophers say of Time and Space.—All the philosophers have admitted something, which, in its relative manifestations is a reality; and which we have called time, space, matter, motion, mind and force; but which, in its ultimate nature is unknown, and by many it is declared to be forever unknowable.

§12, page 70. Comments and Conclusions.—This supposed or assumed Unknowable proves to be not only the first things really known, but in all its differences and relations it is as simple and as easily understood as anything that can be known. When we know that we exist, then the simple effort to understand self-existence leads at once to a clear common sense understanding of the five objects above mentioned, in their true relations to each other and to self. These, to start with, are all we need for the complete Philosophy which explains all Things.

CHAPTER III. GENERAL LAWS, MATERIAL AND MENTAL.

§13, page 76. Matter, Motion, Mind.—Matter is the one thing, in which it was necessary to create difference, in order to create all Material Things. Motion is the one thing, in which it was necessary to create difference, in order to create all Physical Things. Mind is the one thing, in which it was necessary to create difference, in order to create all Mental Things. Things Material, Physical or Mental, in all their actual or possible relations, comprise the Universe of Things.

§14, page 78. Differences, Similarities, Transformations and Uniformities. The Physical and the Mental Universes.

§15, page 85. Inertia-Consciousness.—All things at all times are under the dominion of laws of matter or mind. The first law on the physical side is the Inertia of matter. The first law on the mental side is the Consciousness of matter.

§16, page 88. Physical Energy.—Physical energy is the motion of inert matter, and the law of its conservation is the law of inertia. Mental Energy (the only real energy) is the motion of conscious matter, its persistency and real power being due to the change of inertia into consciousness, thus enabling the conscious matter to control the direction of its own motion as in the ordinary conduct of living things.

§17, page 92. What Science has done for this Philosophy.—All the recent developments of physical science tend to confirm these theoretical conclusions.

§18, page 95. Comments and Conclusion.—The general laws announced in this chapter are carefully applied to all the mysteries of the Physical Universe in the four remaining chapters.

CHAPTER IV. MYSTERIES OF ASTRONOMY.

§19, page 100. Primary Divisions in Matter and Motion.—The two greatest divisions in matter are: (1), Ponderable, or that which has weight and (2), Imponderable, or that which is the mechanical cause of weight. The physical laws which we derive from the inertia of matter, require that all motion should be communicated from body to body thru their contact, and in the form of impact or pressure.

§20, page 102. Gravitation.—Gravitation, or the weight of the planets and other celestial bodies, is due to difference of pressure from the Ether Medium, (imponderable matter) and this pressure is due in turn to the radiation of motion from the sun, the planets and other ponderable bodies, in the forms of light, heat and electricity. Gravitation is explained and brought under the physical laws derived from the inertia of matter.

§21, page 108. Gravity and Cohesion.—All the facts of terrestrial gravity, cohesion, etc. are reduced to physical laws.

§22, page 114. Newton's Law of Gravity.—The law of the action of gravity critically compared to this general theory.

§23, page 117. The Moon and the Tides.—The moon's action in producing the tides is purely physical.

§24, page 120. The Moon's Atmosphere.—The moon's atmosphere was dissipated by physical causes.

§25, page 121. The Sun and the Planets.—Sun Spots, Solar Storms, Magnetic disturbance in the earth and earthquakes are traceable to physical causes.

§26, page 127. Comets.—The repulsive action of the sun on the tails of comets, while they are making their perihelion passage around and near the sun, receives a physical explanation.

CHAPTER V. MYSTERIES OF PHYSICS.

§27, page 133. Sensible and Insensible Forms of Motion.—All forms of motion on the physical side are subject to physical laws. All wave motion should be the same in form.

§28, page 137. Electricity.—All the forms of electricity and magnetism are shown to be forms of motion in the ether medium, in its close relationship to ponderable matter.

§29, page 138. Frictional Electricity.—Motion imparted to the ether may result in its expansion; hence the electro-motive force. The ether is expanded in the same way as any gas.

§30, page 142. Positive and Negative Electricity.—These are due to plus and minus degrees of expansion in the ether.

§31, page 147. Molecular Architecture.—The structure of the molecules revealed by the study of electricity.

§32, page 149. Electric Attraction and Repulsion.—The true and inner nature of electricity is revealed by simple means.

§33, page 152. Voltaic Electricity.—Motion communicated to the ether by chemical action.

§34, page 155. Other Forms of Electricity.—Electric attraction and repulsion and magnetic attraction and repulsion are shown to be due to difference of pressure in the ether medium.

§35, page 159. The Forms of Electricity Compared.—In all the forms of electricity and magnetism thus far compared we are able to see the same simple deportment or manner of action of inert matter in its countless forms of motion.

CHAPTER VI. MYSTERIES OF CHEMISTRY.

§36, page 162. General Facts and Theories.—The atomic theory and other theories and facts of chemistry explained.

§37, page 166. The Theoretical Prospect.—The outlook is good for an electro-mechanical theory of chemistry.

§38, page 169. Molecular Attraction and Repulsion.—This is explained as required by physical laws.

§39, page 174. Record Evidence.—Inference from the established facts of chemistry and physics.

§40, page 182. Experimental Research by Others.—Confirming evidence in the experimental labors of Tyndall and others.

§41, page 192. Artificial and Natural Clouds.—These are explained and reduced to physical laws.

§42, page 196. Snow Crystals.—A physical explanation of the formation of snow stars or crystals.

§43, page 202. Modern Views of the Ether and Electricity.—Critical review of the late book by Prof. Oliver J. Lodge.

§44, page 218. Meteorology.—All the phenomena of the atmosphere are traceable to physical causes.

CHAPTER VII. THE PHYSICAL HEAVENS.

§45, page 221. A General View of the Universe.—The immensity of the universe from this theoretic point of view.

§46, page 225. Gravity among the Stars.—The same mechanical ether pressure and laws of motion are universal.

§47, page 229. The Universal Cycle.—There is a great round of physical changes thru which matter is continually passing.

§48, page 230. The Birth and life of Planetary Systems.—Planetary systems are produced by the condensation of planetary nebula as required by the now accepted nebula theory.

§49, page 233. The Dissolution of Planetary Systems.—Planetary systems are dissipated in space when the last of their radiant motion has deen dissipated; thus suspending the difference of pressure which holds them in their orbits.

§50, page 235. The Origin of Planetary Nebula.—The planetary nebula from which new systems of planets are evolved, are produced by the impact of wandering bodies of inert matter.

§51, page 238. Record Evidence for this Theory.—In the new and temporary stars and in physical laws we find the evidence.

§52, page 242. What are Planetary Nebula?—The beginning and the ending of the great physical series which maintains for a time the many system of planets, may be found in the planetary nebula. This cycle of changes passed in brief review.

§53, page 247. Conclusion.—A number of questions regarding the universe as a whole, are raised as a result of this discussion, five of which have received answers. Questions and answers are briefly as follows:

1. Q. Is the universe limited in space? A. That which exists must be something; and being something, it must be somewhere in space because there is no out of space. If we admit that the universe is something we must admit that it is limited in space, because space in itself is an unlimited nothing. A body of inert matter, limited in space and consisting of discret parts in relative motion, must be bounded on the outside by an absolutely solid or non-porous shell to keep its parts together.

2. Q. Is the universal cycle upon which planet life depends, permanent? A. The balance of evidence seems to be against its being permanent—that it will be succeeded by a universe exclusively adapted to some form of spirit life.

3. Q. Is there anything in this great material system which is superior to physical laws and more worthy of the name Energy or Supreme Mind? A. The universe is clearly a structure; operating in strict obediance to physical laws, perfectly adapted to the support of planetary life and which must have been constructed by a Being of Super-human intellect and power.

4. Q. What are the attributes of God? A. The Supreme God or Spirit, is, and must be, an Individual, existing under the same laws of mind which govern the life of man and the lower animals on this planet. If He is not this we cannot know Him.

5. Q. What is creation? A. Creation is a change in the forms of uncreatable matter, motion and mind, and not only the mind of God, but that of man and the lower animals, are the creators.

6. In Sir Isaac Newton's "Optics," appears a number of statements showing plainly that Newton entertained views regarding the ether medium and the part it takes in light, heat, sound and gravitation, much the same as those of this book.

CHAPTER VIII. RELIGION AND SCIENCE.

PAGES 280-305: A brief review of religion and science past and present. Like science, religion is progressive.

CHAPTER IX. WHAT IS DEMOCRACY?

PAGES 306-337: A Pure Christian Democracy is seen to be the ultimate of mental evolution.

CHAPTER FIRST.

PHILOSOPHY, PAST, PRESENT AND FUTURE.

1. INTRODUCTION.— The sphere of philosophy has always been very wide and uncertain, and we may well ask, what is it? Perhaps its most general and popular divisions known in this country are, Natural and Mental, the former being concerned with the physical laws of matter and the latter with laws of mind. There is also a philosophy of History, which is occupied with rules for the chronological arrangement and accurate statement of important human events in bygone ages.

All the enlightened nations of antiquity had their philosophies, that of the Hindoos being the oldest and that of the ancient Greeks being the most celebrated. The Hindoos have six strictly orthodox systems or schools of philosophy, and in Grecian thought we can distinguish at least twelve different schools. In modern times the philosophers have not been idle. The systems which have gained most attention are those of Locke (perceptive and sensational); Berkley and Hume, (idealism); Reid, (common sense); Kant, (transcendentalism); Fichte, (scientific); Hegel, (idealism); Comte, (positivism); Spencer, (evolutionary); not to mention several new forms of idealism or imported mysticism. The literature of the subject offers many definitions of philosophy, and when we compare a number of them it is not difficult to see the want of agreement. The two following may be taken as a fairly good statement of what it is now generally supposed to be.—

"Philosophy is completely unified knowledge." (Spencer).

But this author has confined our knowledge to the appearance of things only, to the effects they produce in our consciousness. Things in themselves, what they are and whence or whither, we do not know and from the nature of mind we never can know. Another writer answers the question in this way.—

"Philosophy is the search for a comprehensive view of nature, an attempt at an universal explantion of things." (Weber).

The one makes philosophy the unification of knowledge within prescribed limits and is therefore little more than a special science. The other defines it not as knowledge, but as the search for knowledge and the knowledge may be universal. In the one we have the admission that philosophy is knowledge, in the other at least the implication that philosophy may be universal knowledge. In view of these definitions, which are from our most modern authoritiy, and in view of the present work, I have felt justified in offering a definition of philosophy or ultimate knowledge. The following may serve not only as an answer to the question, "what is philosophy?" but it ought to make perfectly clear to the reader the meaning of the title of this book. At least it will make plain what I think philosophy ought to be and perhaps will be in the time to come.

1. PHILOSOPHY IS KNOWLEDGE. If the word has any meaning at all it must be at least this. Knowledge can exist only in a knowing mind, and whether we call it philosophy, science or common information, it can never be more than a knowledge of THINGS and NOTHING. This word "things" or something, is the widest in the English language, and it is wide enough to take in all that exists. The only exclusion to the scope of this word that can be thought of is nothing. Putting these two words togsther, as in nothing-things or nothing-something, we have the form of language which conveys the deepest and strongest contrast or relation of difference. This nothing-something relation I would offer as the great truth which lies at the bottom of all things, and marks the limit of all possible knowledge of things. In the widest and deepest sense, therefore, philosophy is knowledge of all things and nothing.

2. PHILOSOPHY IS THE SCIENCE OF ALL THINGS. Science is now rightly regarded as the higher development of common knowledge and it has a number of natural divisions called the sciences. These divisions systematically arranged constitute philosophy. Philosophy differs from its parts (the sciences) only as aiming to include the whole. The method and the object is the same for both. It is, or should be, the still higher, wider and deeper, development of the same common knowledge which everyone must possess in order to live. It is not only the search for a comprehensive view of nature or an attempt at an universal explanation of things, but it is also the comprehensive view or explanation. Aiming at a knowledge, or being a knowledge, of things in themselves or ultimate truths, it is, for the most part a theoretical science; because, it includes both the things of sense experience and the things which exist beyond the limit of sense experience. For this reason it may be of great value as an applied science in the work of testing the truth of all knowledge or so called knowledge.

Philosophy is completely unified knowledge because it makes use of all the unifying laws of nature, in particular the most general laws. The philosopher who fails to discover the most general law, or to use it in his generalizations, should hesitate to offer his work as a philosophy. To know that all things or even any department of things are united and explained, is to know the law that binds the whole.

Philosophy, as above defined, and as this work aims to make it, is the search for absolute knowledge; and when that search has been rewarded by success it is still philosophy. Now, a definition of things in themselves, also of knowledge, will make our definition of philosophy still more comprehensive. The ultimate cause of things may be briefly stated as follows.

Anything that exists is a thing for three simple reasons:

1. By reason of its Difference from other things and nothing.
2. By reason of its Relations to other things and nothing.
3. Because there is Matter, in which it was necessary for the Creator to create difference in order to create things.

Things and relations are inseparable. The first and most simple relation among all things, and one that is never absent in any case, is difference. It matters not what other relations may exist among things, and there are many others, the one most fundamental, universal and necessary, is this relation of difference. One of the familiar words in our language is difference, and in it we have an appropriate vehicle of a truth which seems to me to lie deeper in the foundation of being than relations. Difference must precede relations simply because relations are impossible without things and things are directly dependent on difference in the fundamental substratum. Difference, therefore, is the first essential to existence. Relations and things are a necessary consequence of difference. Mind and knowledge are dependent upon all three. Next regarding knowledge:

Mind can know only things and empty space or nothing. In itself, knowledge is the mental representation of the truth about things and nothing. But it is assumed to be much more than this. What we call ideas, memories, acquisitions, may be knowledge if they represent the truth. Every different thing, in order to be known, must be distinguished from nothing and from other things thru a sense of their difference. The order of dependence among the principal things essential to knowledge and philosophy, is; (1), difference, (2), things, (3), relations, (4), the consciousness of all the differences and relations among things, as in common knowledge, science and philosophy.

But the knowledge called science and philosophy, to be of value must be of truth; in fact a definition of philosophy and knowledge would hardly be complete without an answer to the question "what is truth?" A primary classification of all things may help us to distinguish the true and the false. In the first place, all things not of mind, properly belong to the Physical Universe. Everything else belongs to the Mental Universe. If knowledge is a series of memories, mental representations or ideas in the mind, then knowledge so far as it is supposed to be of the external physical world, is merely representative; and it may not be of the truth: nothing but pure imagination. Hence another division of all things, and one that should be remembered, is, (1), those things which have a real existence outside the individual mind, (2), those imagined things which exist only in the individual mind. The first named are here supposed to constitute the external world of matter and motion, the existence of which is regarded by many philosophers as not proved. But this view is the only one that fits into the present system; in fact, without it any system at all seems impossible. The last named are all those creations of the mind which misrepresent the things of the external physical world, also the things of the mental world which are external to the individual who misrepresents. From this division of things comes a correlated division of knowledge, or rather, what we call knowledge. All knowledge is, (1), that which mentally and understandingly represents the truth about things either physical or mental; (2), that which misrepresents or fails to understand the truth about things physical or mental. In the first named, we have all our true ideas; real knowledge. In the seconed, all false ideas; not real knowledge. But what is this truth about things, or what is truth?

The only test for truth that seems possible in any case may be found in the well known and highly practical method of common sense and Exact Science. Scientific research is a higher development of ordinary common sense in its practical use in this life. It proceeds on sense experience, judgment, analysis and synthesis, and it aims to discover the general harmony and system among things external to mind, as represented in the harmony of our common sense ideas of things. This I would name the universal, the exclusive and perfectly reliable test for truth. If this Universe is a faultless and harmonious whole, our true representative ideas of things must reveal a like harmony.

This definition of philosophy or ultimate knowledge will no doubt meet with some protest from those persons who put their trust in scriptural revelation and the like. But let them take the widest possible view of the subject from the stand-point of up to date and generally recognized science. Perhaps it will not look so bad. This definition is framed to include all things along with nothing, and it has been carefully applied and justified in these books. It is the only view of the universe and of this problem of life and knowledge, that seems to any extent reasonable. Any system of religion or government, any theory of life for this world or the next, which is not justified by philosophy, does not beserve serious attention. All questions looking to the general good of mankind are questions of knowledge. There is no place in this philosophy for that soulless and one-sided doctrine called materialism, which assumes to explain mind as a simple result of material changes, in which the mind has no controling power over the changes. Neither is there any place for those numerous and just as much one sided air castles of idealism or spiritualism, which profess to ignore material things. To know mental things we must know material things. for it is only in the relations of the two that a knowledge of either is possible. The salvation of the human race for this world or the next. will come, not thru revelations from the Gods, but thru philosophy, and it will not be the academic philosophy now taught in our schools and churches. It goes without saying that what the world needs now more than anything else is a true Philosophy of Things. It is the only means of uniting and proving the truth of all the sciences, and hence all knowledge. It is the only foundation in truth for any form of Government, Religion, Spiritualism or Ethics. That wisdom or philosophy of the far east, of which we hear so much and which is continually being foisted into our western life by the superstitious folk, is not philosophy, because it does not explain things. It is really nothing but a higher development of the power of imagination enforced by a strong will. Imagination can create things unreal, but it cannot learn the truth about real things. The fruits of imagination have no permanent intellectual value for society because they are the creations of an undeveloped mind. The fruits of reason have a permanent intellectual value for society because reason can only proceed on real knowledge of real things, which things are permanent. Imagination can cure disease, it can make a man contented and happy, it can even create for him a spirit world here on earth, but it can do nothing for his intellectual development. It is not here assumed that the creations of imagination are not in themselves real. They are not only real things, (mental forms) in the brain of man, but they can be externalized or duplicated in the surroundings of the man. They are false only in so far as they fail to represent the truth about the external reality. In book 2 it will be shown how all objects in the future life are created by that power of mind, which, in one of its forms we call imagination.

The present life is the exercise of the individual mind under necessary physical conditions; which conditions are in fact indispensable to its higher development. All life may be made better or worse by the right or wrong use of mind. This seems a wise dispensation on which rests the great law of Mental Evolution, to be considered in book 2. In the evolutionary stages of mental development knowledge of truth has an indispensable practical value, because it is one of the necessary means to the good things of life. But good things must be mingled with bad things, and truth with error, and we must be liable to mistakes for we must learn by actual experience, to distinguish the good from the bad and the true from the false. We are here to learn by sense experience, not to be instructed by some super-human intelligence. The end of evolution is the perfection of the intellect, the goal of all life; and so the individual comes into harmony with the Supreme, in the perfect life, in which all that is, is good because it is necessary to the perfect whole.

The problem which is no doubt the greatest of all problems is now fairly before us. If the salvation of man must depend on philosophy, the future course of human progress cannot be misunderstood. It is simply a question of man's relations to the Universe of things, in particular his origin and destiny. We must now recognize the true relations of man to the lower animals, and we cannot rest our distinctions on purely anatomical or bodily differences. It is strictly a case of mental development, in which the mind of the man gradually grows out of the mind of the animal. At the beginning of the 19th century (1801) Lamarck first published his conclusions on the origin of man, and the work attracted much attention. He upheld the doctrine that all species or living things, including man, are descended from other species, and hence the generic relationship of all life. At that time many persons began to realize the high probability that all changes in both the organic and inorganic worlds are a result of natural law and not of miraculous creation. But to Charles Darwin more than to any other person we are indebted for the complete settlement of this question. He clearly foresaw the revolution which was to take place in natural history. The naturalist can now pursue his work without any troublesome questions as to what species any plant or animal may belong, for there are no clearly marked lines between the species, not excluding man. The evidence of the inhumanity of man is perhaps most conspicuous in his mental peculiarities. The real human quality in the mind of the average man shows itself for the most part in his intellectual and moral attainments, also in that high regard for the value of this life, in self and others, as a result of a comprehensive understanding of it and a very earnest desire to make the best possible use of it. The fighting and killing propensity is not human. It comes from a deficiency of mental development more or less conspicuous in all animals, and it will disappear as fast as the higher human qualities can be made to take its place. He who kills for spite, or sport, or any selfish motive, is not a Christian, no matter what he kills. The only human excuse for taking the life of any creature is in the defence of self or society. Tho necessary in the evolution of life in its stages lower than man, the desire to kill is an animal characteristic which must be eliminated in the humanization of man. The lower animals do not deliberate these questions because they are not far enough advanced mentally. But they live under the physical conditions which are well calculated to help them, and which were no doubt prescribed for them under the general law of mental evolution, hence they must obey the law and live a selfish, fighting life in the conflict of which only the best fighters can survive. To a great extent the same is true of man. Animal or man, we are all in the service of God and he who has been most successful in the battle of life has rendered the best service. But we of the more human kind can serve God in more ways than one and it is for us to decide which way is best. It is a simple question of difference between man and animal mentally considered. All that makes a man immoral or selfish, all the varied forms of human depravity without exception, are traits of the animal handed down from the remote past and to get rid of them is to cultivate the human traits. Men in future will cease to act like animals and strive to emulate the higher human qualities, and so the blood thirsty brute will go out and a purely human stock will gradually come in.

Any religion which does not teach this doctrine, or to be more precise, any religion which does not teach the whole truth about man, has missed its high office just that much. It is not enough for a man to be a strictly moral person. Knowledge and intellect are equally necessary. The worship of an unknown God supposed to live somewhere above the clouds is no better than the worship of a shape carved in wood or stone. Convince a man that he has the elements of the brute in his mental make up and if there is a small spark of humanity in him it will be fanned into the blaze of self respect which will regenerate the man quicker than all the common pulpet thunder that you can fire at him. The religion of the emotional kind is going out of fashion. Thinking men do not howl like dogs when the cathedral bells begin their solemn racket.

No doubt there are many who will admit the soundness of the theory that knowledge of real things and their relations is of first importance in life, and yet will contend that they are doing the right thing. They admit the need of progress in every thing but their established religion; but it must be admitted that all religions, all forms of government or movements for man's amelioration, have been reproached for being out of harmony with the advance of general knowledge. The truth is, the world of progress has been slowly emerging from its animal ignorance into the light of science, and now more than ever before it needs a true philosophy to guide it to victory. Science has already done more for true religion then all the prophets, saints or priests, andphilosophy is simply an application of the scientific method to ultimate things. It has been said that the rules of philosophizing have never been laid down with sufficient precision to be of much service. It seems that no one heretofore has known just how to make a start. The method of analysis and synthesis (§ 3), as used in speculative thought, seems to me to be the only means possible, but I do not know of one case of its successful application to fundamental truths. By analysis, we get things separated down to their utmost parts, and distinguished by simple difference. By synthesis, and in view of general laws, we discover the systematic relations of things as appears in the harmony of our common sense ideas of them. This method has been well tried and never found deficient in scientific research. What would be the result if we apply it to philosophy? What is a thing; and why, or how, does it exist? Why is it possible for a mind to ask such questions? Have we any ideas about things, and if so how did we get them? I have been asking such questions for half a century and I am still at it, but I am not able to think myself away from those simple inborn ideas which every man has and must have if he thinks at all. No matter how I think, I must think of something, as being in some way related to myself; then I have two things, self and the other thing, and I must think of these things as being somewhere in space and as having some duration in time. I cannot think or know, without something to think about or know of, and the things must be in time and space with myself, and I must distinguish the things, one from another and from time and space, by their difference. These, for me, are the only conditions of thought, or even existence. Without difference, there are no things, no relations, no thought, no knowledge, no mind or life; nothing but empty space or nothing.

This I venture to call the common sense view of the world. If we apply this simple idea (definition of things and knowledge p. 3,) to our common ideas of Time, Space, Matter, Motion, Mind, the result is surprising indeed, and highly gratifying. Time is only an object of thought; and only as related to that which has a continued existence. In itself it is not a thing. It is the name we have given to the duration or past, present and future, of existing things; and without which there would be no time. And so with space. In itself, space is nothing. In its relation to that which occupies space it is a necessary object of thought. But what is that thing which must occupy space and time in order to be something and which is so necessary to the objective reality of both? Long ago the common sense of mankind forced him to recognize this collective entity and he has called it Matter; and the name sticks in spite of that premature spiritual phase of thought which tries to shake it off. It is a noteworthy fact that those persons who deny the reality of matter admit the same thing under a different name, more mysterious and hence more delusive; indeed they cannot think without it, but being totally ignorant of the conditions of thought they can rest contented in their delusion. A good dose of reason to clean out and regulate their system of ideas might help them. Matter is a thing because it differs from time and space and the other ultimates. It is also a thing because of its own peculiar relations to the five other ultimates, and in this respect it stands absolutely alone. Motion is another distinct thing because it is not like matter. The difference here is conspicuous, and no man of ordinary gumption ever gets these two things mixed. It is only the philosopher and the high flying ecclesiastic who fail to see the difference. Mind is another distinct thing simply because it is not matter or motion; neither is it time, or space, or anything but mind. Here we have five ultimate objects of thought which we have called time, space, matter, motion, mind. That all these are distinguished and known by their difference, and that they bear certain well marked and necessary relations to one another, seems beyond any possible dispute. Matter is the one thing at the bottom of all other things, simply because it is the only space occupant. Since there is mothing outside of matter but empty space, motion and mind must be of matter. Matter, motion and mind are things because they are something. Space and time are not things because, in themselves they are nothing.

Now, if this view is right then we are confronted by a most astounding truth. Ever since men have been able to think like human beings these five simple objects have been known to him. He has known them all the time and he knows them now, but he don't know it. And what have the philosophers done to help him to his own? Worse than nothing. They have labored incessantly to befog, bewilder and degrade human understanding on this subject; and all the time they thought they were doing the best that could be done, and who can blame them? But they deserve the severes censure and in the next section I have given these philosophers special attention.

It is my object herein to try to make it clear that these five simple objects or things, when viewed in their true and clearly necessary relationship, are indispensable to the very conditions under which conscious life or anything else is possible. To rightly understand these five objects is to make the first step in philosophy. More would be unnecessary and less would be fatal to the existing order and to all life. In these we can find and solve the 'Riddle of the Universe.' Matter is the universal substratum in which it is necessary to create difference in order to create all things. Under the motion of inert matter we can unite and explain everything in the Physical Universe. Under the motion of conscious matter we can unite and explain everything in the Mental Universe. When matter is conscious it is not inert and so may control the direction of its own motion as in ordinary conduct. The only power, force or energy, in the universe is in the conscious mind, and it appears in all life from the lowest plant up to man and on up to the Supreme Mind.

Let us realize the possible truth that the God of Nature, in His great wisdom and goodness, has prescribed a perfect course, in the material conditions of this life, for the growth and maturity of the faculty of Rational Thought in men. Physical nature with her Material forms and Mechanical Laws has deen constituted just as we find it for the implied purpose of affording to Mind an objective reality of Things and Nothing, upon which it can exercise itself and develop thru sense experience as required under the law of Mental Evolution. The forms of matter and motion must serve as original patterns for mental things; but the mental things may be changed and improved upon by a free mind. The life of every thing that lives is made by its progenitors and itself under these indispensable physical conditions. For the making of our future life, either Heaven or Hell, we must have just such a world as the present to begin with, and then to make the first right step toward the higher spiritual life we must understand this world of matter and motion. For a true Philosophy of Things there is no object more worthy.

2. SOPHISTICATED PHILOSOPHY.— When the mind of man is fresh and buoyant, but not tempered by the judgment which can only proceed on real knowledge of real things, it is apt to confound truth and fancy and thus build airy systems of ideas which its native vanity mistakes for truth, and by which self and others are misled. The fighting spirit and the love for conquest has led a number of writers to find in this an attractive field for exercise. Such persons are rightly called sophists; artful reasoners who adulterate and debase any subject that happens to take their fancy. But all such persons are playing a necessary part in the evolution of right thinking.

The field of philosophy has not been neglected by the sophister. From the literature of the subject it seems that we can place all the philosophers, past and present, in two classes, (1) those who have recognized the real questions involved, and have done much commendable work toward clearing the way to a solution of them; (2) those who have labored to establish their sophisticated notion that such questions cannot be answered. The first named have left the problem open and encouraging to the outlook of future knowledge, and they deserve the highest regard of posterity. The last named have done little or nothing but obstruct and discourage human effort in this direction, and their influence has been felt in all circles. Hence it is that philosophy has been, and still is, for the average reader, the most confounding and aggravating subject in all literature. If the word stands for real knowledge, it has been misused more than any other word in our language. Just as soon as we begin to see things right we make the discovery that the great majority of such persons are a lot of incapables who have been educated out of that natural sense judgment which is the inheritance of everything in human shape. It is a clear case of incompetency and hence bad treatment of the subject on the part of the so called philosopher; his wretched deficiency of common sense as shown in his inability to see the meaning of general truths, even the simplest and best known truths of mind and matter, and apply them in the same way we do in the common affairs of life; his emotional and affected show of great learning, and to the reader who wants to know the truth his most painful obscurity of meaning. It is certanly not true that very many of those who have entered this field of labor, have proved themselves worthy of the honorable title of lover of knowledge' by facing the questions of philosophy with the spirit that never plays quit. The quitter in this field of human effort is just as unworthy of our respect as he is in any other, and when he succeeds in fooling so many of those good people who cannot think for themselves, it is high time for somebody to get after him and just knock the stuffing of sophistry out of him. It is a fact well known that many of those who have attracted public attention by being boosted by publishers and others in high places, have strenuously labored to prove to the world that a knowledge of ultimate truths is unattainable. Their long arguments have appeared regularly to this end, which might have been given to a better cause. Each new philosopher of the disparagement class has come out with a new version of the same old question, but instead of answering it or even allowing that some one else may be able to answer it, he carefully draws the line which defines his ideas about the necessary limit of human knowledge and capacity, and he always makes his line to correspond exactly with his own ignorance and inability to master the problem. This idea of an "Unknowable Adsolute" has now come to be so common that we seldom hear of any one who has not accepted it, and it is often urged that philosophy is an unprofitable study which should have no place in the pursuit of knowledge. It seems now that the only excuse for the philosopher is to be engaged in this everlasting pursuit of something which can never be attained. The chase is more to be desired than the object pursued because in the attainment of the object philosophy would have to close up shop. It is claimed that the cultivation of philosophy is not knowledge but mental discipline. We are supposed to get the training which fits us for the common occupations of life. But this is surely a mistake. To think like some of these philosophers, would be to ruin that common judgment faculty which every man needs so much, and to which the future hope of philosophy and religion must look. In books on the subject we often meet with passages like the following:

"If I held truth captive in my hand I should open my hand and let it fly in order that I might again pursue and capture it." Or this: "Did the Almighty, holding in his right hand truth, and in his left hand, search for truth, offer the one to me which I preferred, in all humiliation but without hesitation I should accept the latter." Of course it is an honor to search for truth if only for the prize of truth, and no doubt it is most pleasing to the Almighty, but if for the mere pleasure of the search it is to make a farce of the best of all pursuits. It is a reproach to the philosophy which seeks truth for its own sake and the true philosopher finds no pleasure in ignorance.

The education of the present day never makes a philosopher and it is liable to spoil the born philosopher. I mean of course those forms of Positivism or Idealism now taught by the college and the church. The ordinary man thinks with the ideas he gets directly from the things which he can see, hear, taste, smell and touch, and so his ideas which are the components of his philosophy are thus steeped in the very nature of things, in the essential conditions of all life and he has got to have such ideas in order to live. His education is that of sense experience, properly called common sense But personally he never thinks he is a philosopher; while the other fellow, the self-ordained philosopher, can hardly think of anything else. His philosophy is an important part of his education, it has come from the highest authority and he has laborsd hard to get it. But it makes him think only in the words and ideas gathered from his books and what do they contain? Sophistry! But he has so much respect for his delusive authority, and so little innate capacity for originality, that he can only imitate; and so he comes to be a mere ape-like man, less worthy of our respect than the man-like ape because he has failed to take hold of the opportunities of life.

For millions of generations we have been gathering and handing down our common ideas of things, until now we have them well soaked in and about the best way to get rid of them is to go to college and try to be a philosopher. The very thing best calculated to kill the embryo of a real philosopher, and the one thing necessary to make a counterfeit. When a man gets this infection he starts in for the education which he thinks is necessary to his making. He studies everything from Plato to William James and so fills his head with all kinds of ideas that real philosophy never had any use for. Then he is able to see things in empty space and sometimes he is not able to see anything in real things. Then he begins to write books, and what is the result? His ideas don't fit together and they refuse to harmonize with the little common sense left in him. But he has faith in his fine education and his prodigious collection of book ideas. They are his only hope. Common sense is too common.

So what can the poor sap-head do? Stick to his ideas and work with wonderful persistence and patience, until he has forced them into something like a system; then rest in the delusion that he has reached the limit of human achivement, and thus he settles the great question for all the world.

Undoubtedly that class of literature, which has flourished under the honorable name of philosophy to the detriment of knowledge, and has been successful only in revealing the vanity of the writer and sorely taxing the patience of the reader who wants to know the truth, will cease to take the attention of the student, if philosophy should gain its object. So let us help it along if we can. But we may find some good in the erudite philosopher if we look at him in the light which reveals some good in everything. In the confusion which he has wrought we are made to feel the need of order. It is through the mistakes of self and others that we learn wisdom, Truth must be judged by knowing its true relations to fallacy and to mankind as a whole. The wrong going of the philosophers of each generation has stimulated others coming after them, into new lines of thought, and so the mental range has grown wider until it has covered nearly all questions; and it is still growing. But the leaders in new lines are few when compared to the great number who follow them. To imitate, is the animal way; to originate, and to move for better things, is the human way. If the bell-sheep jumps over the highest part of the fence the rest of the flock will follow him, even when there is a wide open gap just to the right or left. The philosophers of the past and present have been lacking in originality. We have now had enough of the animal philosophy. But the new philosophy will be nothing new in thought. It will be a revival of common sense, and a restoration of it to its right place in philosophy.

The above remarks should be justified by a few examples, and first let us notice the two classes of philosophers called the Realists and the Idealists. The first named, so far as they have ventured, are on the safe ground of truth as I understand it; and the second have departed most from the truth. Realism contends for the reality of a world of matter and motion, external to mind, and which we perceive directly. The realist does not assume that we know all about this external world, but this much we do know, and it may be possible to know more. It is simply a question of the further progress of knowledge, and since all scientific knowledge has steadily advanced in this one direction and since it is in perfect harmony with the universal common sense of mankind, the outlook for realism is certainly not bad. The realist maintains that we cannot know the qualities or properties of matter without knowing matter itself, and he freely admits that some of the apparent qualities of matter, (as color, taste, smell, heat etc), may not be in the substance, but only in the mind. So far as we know they may be creations of the mind itself—forms of memory which have been associated with certain forms of motion in matter, and by which motion they are revived into consciousness; and so take part in our perceptions of external physical things. And this is most likely what they will prove to be when our philosophy is complete. Realism is the philosophy of common sense, and it is what I am fighting for in this book.

The assumption of Idealism is, that since some of our sense perceptions must be at least partly confined to the mind itself, all may be so, and hence we cannot know material things. The thing which we call matter is first of all an idea; but whether it represents anything else not of mind, we do not know, and from the nature of mind it is supposed that we never can know. And so the Idealist cuts this gross material world from his unbending mind and joins his little band of book-gleaned ideas. He thinks only the little thinks which revolve in his little head, and never a think does he ever think as to how or why he thinks. Not being able to think of anything in this vast physical world, nothing new ever gets into his philosophy but a name or a shape. There are many forms of Idealism too numerous to mention in detail here; in fact any system of philosophy which cannot accept the sensible forms of matter and motion as the original patterns of its ideas, must depend on pure mind made ideas, which may not represent anything but themselves. Skepticism is necessarally a form of Idealism because its principle argument rests on exactly the same foundation. If our senses fail to tell us the truth in some cases they are not to be trusted in any case. The conspicuous truth that the physical sense may be so thoroughly trained that it can be depended upon in all cases, is not considered. And so with all the many forms of Spiritualism; even Materialism and Agnosticism, the one regarding mind as a mere result of material changes having no control over them, and the other believing that nothing can be known beyond the sphere of the physical sense, must be included in this category. They are all limited and onesided views of the Universe in which the general harmony of common ideas is conspicuously absent. The logic which prompts a man to affirm that we cannot know matter, should also prompt him to affirm that we cannot know mind or spirit, for in this life we know the mind or spirit of another person only through the movements of his body and the movements of the body are those of matter. And so the logic of all such thinkers is turned against them. If we cannot know the spirit of our neighbor how can we ever know the spirit of God? If the Idealist will push his logic to its legitimate end he will find himself shut in a small mental world, created by his own imagination and limited by his own skin. The great world outside of his skin is nothing to him but an everlasting riddle. He has no God, no fellowship with men and a more complete state of ignorance could hardly be imagined. This would be just the thing for all those persons to whom ignorance is bliss. So much for the logic of Idealism.

But if all knowledge can be nothing in itself but a system of ideas in the mind, then what is Realism but a system of idealism? This is exactly what it is, and the question for us to decide is, what is the true Idealism? That Realism, Science and Common Sense, are now steadily, but too slowly, moving toward the true Ideal-realistic-philosophy, is not doubtful to me. It is simply that system of ideas which accept the forms of matter and motion, governed by physical laws, (described in this book) as the original and necessary patterns of the ideas which every man must have if he lives at all and which we know before we know anything else. The external world is a material reality, made not by us but for us, out of existing material and by the Mind that moves worlds as we move atoms; eternal in time and space and absolutely necessary to the beginning of planetary life. To live at all, we must begin life under physical conditions, and we must have ideas, and to live the perfect life, or as near to it as we can, we must have true ideas. Each idea is necessarily a mental representation of something true or not true To know whether the represented thing is real or not, we must try to make it fit into our most general system of things. If it will not fit we must bounce it at once; provided that we can feel assured that our system is the most complete. This most general fitness of common things is the sure test for all philosophy, If in building our system of ideas we find it necessary to retain our common ideas of matter and motion, then for truth's sake let us hold on to them. It is on these that the entire structure of the Physical Universe must rest.

The trouble with Realism at present is, that it cannot prove its position, hence it is open to the continuous attack of the Idealist. This warfare has been going on for two thousand years and no let up in sight; in fact the Idealists are getting more numerous and rampant. Let us take a brief survey of the history of the two. So far as known to me Realism commenced with the Greeks in the doctrine of atoms. The atomic theory was first proposed by Lucippus and later developed by Democritus and Epicurus. Democritus, who lived about 460 B. C. entertained ideas about the atoms and the ultimate nature of things, which are remarkable for their simplicity; and which, it seems to me, should never be overlooked by the student. My reading is not the most extensive, but so far as it goes and if my understanding is right, this philosopher has clearly recognized what I would regard as the most important distinction in philosophy; properly called the Space-Matter relation. We might also call it the Nothing-Something relation, Democritus taught that all things may be found in the Plenum and the Void. The word plenum was from the Latin and it originally ment that state in which space is completely filled with matter. The word Void, is also Latin and it means deprived, unoccupied. As an Englsh adjective it means empty; not containing matter; not occupied; unfilled; vacant. Thus according to Democritus, Being or Existence, occupies space and is contained exclusively in matter, while non-being or nothing is the void or empty space. He belived that all material things are composed of ultimate atoms; insensible particles of real substance. underived and imperishable. They differed in size and shape, possessed weight and motion, and in their combinations and separations he proposed to account for all things both organic and inorganic. He recognized two primary properties in matter; extension and resistence; but mind was not a secondary property. In his religious teaching he opposed the then popular theology, His moral doctrine was cheerfulness and square dealing.

Now the thing which takes our attention most in this philosophy, is its wonderful simplicity, with the fact that it goes to the bottum of all things. The primary properties of matter known to the Greeks, are still recognized as the most conspicuous of material facts; and we have only added to them. In the course of this work it will appear that every thing in mind is a secondary property of matter; and the same is true of Inertia, which governs all physical activities. The resistence of matter known to the Greeks, is very likely what we now call inertia. This simple philosophy is conspicuous in the common sense of the common people to day and it has been so in all past ages. Think of this. In the common sense view of the Greeks, more than two thousand years ago, we find clearly express, the very foundation principles of the only possible system of philosophy; lacking only in that further development which would have made it the greatest boon to the human race; which would have made impossible all those pernicious systems of Agnosticism, Materialism, Atheism, Mysticism or in one word Idealism. This, at least, is the view that I must take after a hasty reading of the subject, and if true it is a noteworthy fact in view of what follows.

The common sense of the Greeks was not allowed to flourish without opposition. The sophisticated Idealist was as pugnacious then as he is to day, and his principal excuse, then, as now, was that most unreasonable fear that the admission of the theory of atoms, would lead to that narrow materialistic atheism which denies the Deity. Of all the senseless delusions that ever hampered human progress this takes the lead. There is absolutely no reason for the idea that the belief in material things is not in harmony with the belief in spiritual things. It fails to satisfy reason and it supports the argument for sophistry. A sophist in the modern sense is a clever disputant who seems to care more for the point than he does for the truth. Socrates and Plato were prominent among the Greek opponents of the atomic philosophy. The great pleasure of Socrates was to meet the men of his time who thought they knew something about this external world, and get them into an argument; then he would sail in with his sceathing logic and make them look cheap. When hard pressed he could always take refuge in his aircastle of Idealism. "The only thing I really know is myself" Plato became prominent for his theory of "Eternal Self-existent Ideas or Forms of Mind" He also made improvements in the Gods, introducing a supreme God to take care of the smaller Gods. It is said that in all his writing there is nothing like a connected system. G. H. Lewes,in his history of philosophy, says of Plato. "I come to the conclusion that he never systematized his thoughts but allowed free play to skepticism, taking opposite sides in every debate, because he had no steady convictions to guide him; unsaying to day what he had said yesterday, satisfied to show the weakness of an opponent". Plato belived in a Supreme God and in the immortality of the human soul, but it does not appear that he offered any evidence for his beliefs. Like all or most of the Greek philosopher he was a double materialist;believeing in a mind substance, as distinct from ordinary matter. With all the Greeks there is more or less confusion of ideas. All have made the mistake of regarding mind and matter as two substances, and all but the atomists, have failed to recognize the first and most necessary distinction in philosophy; that of space and matter.

Platonic philosophy has met with favor among the Idealists in all ages and its advocates to day are well known teachers of philosophy in the Colleges. In modern times the most distinguished philosophers in nearly all the civilized countries have been Idealists of one type or another, and here it will be well to mention the views of a few of them regarding the ultimate.

Emanuel Kant the greatest of the German philosophers, believed that space and time, with all their vast distances and periods of duration, were not outside of a man's mind, but inside of it. What we call space and time are only ideas; at least this is all we can know about it. Since we must keep all our ideas in our heads, we cannot expect to have any space or time outside of us. The common sense man will be sorely puzzled to know how we manage to move about without any space to move in; but then, common sense is not Idealistic philosophy.

George Berkeley the greatest of the Irish philosophers and a distinguished Bishop besides, took a directly opposite view. He contended that space and time, with all their great bodies of matter, are not in a man's head, but outside of it; and what's more, the outside world is not what we think it is—a world of material bodies—but a world of pure mind; composed of ideas alone, and the very same ideas too which the man thinks he is carrying around in his own head. Here is where the common sense man gets a jog which makes him think the world is on a jag. More remarkable is the fact that learned men have argued that Berkeley's Idealism is in perfect harmony with reason.

Next comes Sir William Hamilton the most distinguished of the Scotch philosophers, with his positive dictum, that we know nothing and never can know anything about either time, space, matter, motion or mind, in their ultimate nature. "Our knowledge' he says, 'whether of mind or matter, can be nothing more than a knowledge of the relative manifestations of an existence, which, in itself, it is our highest wisdom to recognize as beyond the reach of philosophy." In other places he includes time, space and motion or energy, in his category of unknowables. This I would regard as a clear case of failure to grasp the full meaning of the law of Relativity. In the above quotation he ought to have said, the relative manifestations of EXISTENCE-NONEXISTENCE. He failed to recognize that most necessary space-matter distinction clearly made by the Greeks long before. The prestige of this philosopher has done much to give currency to the doctrine of an unknowable something, which others have labored to promulgate under different names or forms.

Next to be mentioned is August Comte the most eminent of the French philosophers. Like the others he prescribes a limited sphere of knowledge which even seems more limited. He starts with the Cartesian idea that sense experience is the only inlet for knowledge, and so far he is right. Whatever sense reports to us is something and our business is to give it careful attention by the use of sense and judgment. What we can learn in this way, is real knowledge. But here he gracefully falls into the metaphysical trap which has caught so many others. This, he says, is the only possible knowledge. All attempts to account for things; all conjecture about orginal causes or possible effects; all speculations as to the relations of the things of sense to things beyond sense, are vain and profitless. Human knowledge can be nothing but applied science. There is no such thing as theory or theoretical science, and hence nothing that can be properly called philosophy or religion, in the sense that these departments of knowledge relate to things beyond the range of experience. The philosophy of Comte consists wholly in his co-ordination and classification of all the applied sciences, into one great applied science; and this is his Positive Philosophy. His religion is the practical application of his philosophy to humanity; what we know and can use in the present life for the good of self and others.

Next in line comes Herbert Spencer, who is now regarded by the learned world as the first of philosophers. He has built up a complete system, and though not the first to makc the attempt, it is believed that he is the first to succeed. I have a brief review of the system of Spencer in my chapter on evolution, book 2. Here I would like to show the effect of his teaching on myself years ago while engaged in this work,

If my memory is correct it was in the year 1860 that I commenced to think about the nature of things. Most people think about things when they are not dreaming, but it is not everybody that wants to know why a thing is a thing. This was one of my troubles. Well I finally got it fixed up.in my head that everything that exists must exist in time and space; must take some time in which to exist and must be somewhere in space. This idea struck me kindah natural and I thought it was all right. Later on the idea of difference as necessary to the existence of a variety of things, worked its way into my uppermost parts, and then came the idea of the relation of things. Finally I adopted the idea of matter with its motion, its inertia, its conscious and its unconscious states, as the one thing which occupies time and space, and in which it was necessary to create difference in order to create all things. I got some good ideas about the inertia of matter and the mechanics of motion from the two well known school books on Natural Philosophy by David A. Wells and G. P. Quackenbos. All these ideas, (for which I gladly acknowledge my indebtedness to the good books) seemed to me to come nicely together and I have found them indispensable to my system. I then thought that I knew what time and space, or matter and motion are, just as any common sense man always thinks. I did not know any better and now it seems that my ignorance saved my system. It was in 1881, after perfecting my system as far as it then seemed possible, that I was advised to get a copy of Spencer's First Principles, and so I did. He was recommended as the highest modern authority on the subject and of course my expectations were considerably worked up. In the reading of this book I got along fairly well until I struck Chapter 3 on Ultimate Scientific Ideas. Here I was knocked into the worst bedlam of bewilderment I ever experienced. For months I could do hardly anything but ask myself; what is the matter of my mind? Is this philosophy? It was my first dip into the literature of general philosophy, and I read this chapter again and again, and tried my best to make out some conclusion about it. What hit me the hardest of all, was the fact that, in this chapter, not only time and space, but matter, motion, mind and force, in themselves, are all declared to be, now and for ever incomprehensible. And this was first principles from the highest known authority. But how could a first principle be known as such and yet be totally unknowable in itself? How could a great publishing house and so many well known scientists and preachers indorse such teaching if it is not true? Such questions made havoc in my brain and of course I was confounded and laid up for a long time. To make the situation worse I was often reminded by well meaning friends that such an undertaking can only end in failure. It had required just such a man as Spencer, with his encyclopedic knowledge and his profoundly analytical mind, to realize the truth of the utter impossibility of ever reaching an answer to such questions. But my first born and favorite ideas had taken deep root in my brain, and in them I could seem to find a way out of the difficulty. I must see what this chap is driveing at, I thought, because if I can understand him perhaps I can see whether he is right or wrong. So I kept on reading and went clean through his 24 elaborate chapters on the Laws of the Knowable. In 11 of these chapters he has reviewed all of the known facts of physical science, and arranged them under what he calls the "law of the continuous redistribution of matter and motion" This is as far as he gets toward revealing the first principal of the Physical Universe, and what has he got? When I had followed him this far I felt convinced that I could see his mistake. This continuous redistribution of matter and motion, is very far from being the most fundamental principle. Long before this I had learned from those old school books, the general truth of the Inertia of Matter, and this was one of the good ideas that stayed with me. Her is the first passage I ever read in which this idea is clearly expressed:—

"Inertia signifies the total absence in a body of all power to change its state. If a body is at rest, it can not of itself commence moving; and if a body be in motion, it can not of itself stop, or come to rest." (Well's Natural Philosophy; p. 16.)

This, I would call the First Principle of the Physical Universe, and on it I have built my system. Here it is worth while to remark that the word inertia occurs but once in the First Principles, by Herbert Spencer; and strange to relate, its importance as a first principle, is duly recognized. Here it is:—

"In the case of matter moving through space, this principle is expressed in the law of inertia—a law on which the calculations of physical astronomy are wholly based." (p.226.)

But he certainly did not make use of this principle in his generalizations. This law is not only the basis of Astronomical calculations, but also those of Physics and Chemistry; in short the entire Physical side of the Universe. So I was beginning to catch on. This continuous redistribution &c. is no principle at all. Make of it what you will, it is nothing but a general statement—and an exceedingly artificial, overworked, bewildering and unnecessary one at that—of a series of physical changes going on in matter. The underlyeing principle was not so much as favored by a glimpse from this philosopher. To say that matter moves continuously, is not to explain why it moves.

Now let us return to Chap. 3 of Mr Spencer's work. The very first sentence in this chapter contains a brazen fallacy which any common person cannot fail to see, He first asks:—

"What are Space and Time? Two hypotheses are current respecting them; the one that they are objective, the other that they are subjective. Let us see what becomes of these hypotheses under anlysis."

Then he begins to analyze, and in what follows we are supposed to have an example of the analytical powers of a master.

"To say that space and time exist objectively, is to say that they are entities."

Now, is this true? We will refer the matter to the best English Dictionary.:—

"Entity is the quality or condition of something which really exists; being; existence; essence. Fortune is not real entity nor physical essence, but a mere relative signification."

But a fortune may be an object of thought, in fact there are many people who think very little of anything else. Very many objects of thought might be named, which exist only because of their relation to other and real things. Any real thing may be an object of thought, but all objects of thought are not real things. (sec. 8). An entity is a time and space occupyeing thing just as matter is, or as motion is, or as mind is. But are time and space, time and space occupyeing things in the same sense? Of-course not, and no one thinks so. We can think of sound and we can think of the absence of sound, and both are objects of thought, but sound and silence are not both things in the same sense; in fact, silence is nothing in itself; it comes to be an object only in its relation to sound. And so with time and space on the one side, and the Universe of things on the other; both are objects of thought but both are not real things in the same sense of the word. The analytical argument of Mr Spencer, commenced as above, continues thru many pages of print and not one of his conclusions are justified by fact or reason. All of them may be shown to be untenable but it would be out of place to attempt it here. I will mention only his conclusion regarding time and space. He says:—

"Thus as space and time can be neither non-entities nor the attributes of entities, we are compelled to consider them as entities." Under this wrong assumption he gives them a very elaborate consideration, which brings him to the result below.

"It results therefore that space and time are wholly incomprehensible. The immediate knowledge which we seem to have of them proves, when examined, to be total ignorance."

And so with all the ultimate objects or things. This long argument to prove our total ignorance of time and space is applied the same to matter motion and mind. If any reasonable person will carefully examine this argument, he will be lead to suspect that Mr Spencer has played false with his own reason. He sees that time and space are objects, but he cannot see that nothing is an object in exactly the same sense. It is an object only in is relation to matter, or something in matter. He sees, or pretends to see, that time and space, being objects, must be regarded as entities, or real things like matter; and he fails to see that they may be objects as related to matter, while in themselves they are nothing. He sees absurdity in calling them nothing, because he thinks we would then have two kinds of nothing; and he fails to see that if they were nothing, both would be the same object. In short he sees anything that will help him to make his point, while he overlooks everything that might lead him to the truth. For me it is all pure sophistry.

But Mr. Spencer worked hard all his life to gain his object, which was that of the true philosopher; the synthesis of knowledge. We ought to judge him fairly, now that he has gone to his reward, and give him credit for all he is worth. There are others now living and well able to take care of themselves, who should have some attention here. So far as known to me the chief promoters of philosophy at the present time are Idealists, and they are also College men. Prominent among these may be mentioned William James, Harvard College; Borden P.Bowne, Boston University; John Dewey, Chicago Univercity; Joseph Royce, Harvard; F. C. S. Schiller, Oxford England; Fredric Harrison, London England, and Mrs. M. G. B. Eddy, with her numerous followers who call themselves Christian Scientists, and who also have a system of Idealism. All of these persons have written books on this subject, which are shaping public opinion. Some of their sayings on the space matter relation, should be noticed here. Prof. James, in his late book 'The Will To Believe' offers the following:—

"Consider for example, space. It is a unit. No power can in any way break, wound or tear it. It has no points between which you can pass your amputating knife, for it penetrates the knife and is not split. To make a hole you must drive some other thing through. But what can you drive through space except what is itself spatial?"

If the above had been written for a joke we might find a good laugh in it, but it gives us a tinge of sadness; he really means what he says. If we ask the common clodhopper why it is that we cannot bore holes in space, he promptly replies. "Y, when we bore holes, wev got to have somethin to bore em in." To him, space is nothing, and he thinks so because of his long experience with material things, which he knows by their differences and relations. It is the same experience that enables him to drive a nail into a board. He can see the difference between the nail and the board, and he knows that both are real things. For this simple reason he never tries to drive nails into empty space. I am not able to see it in any other way.

Prof. James does not agree with the English philosopher. On the contrary, space and time are real things which we do know with complete unmistakableness. Read what he says:—

"Thus with space our intelligence is absolutely intimate; it is rationally and transparently incarnate. The same may be said of the ego and of time, But if for simplicityes sake we ignord them we may truly say that when we desiderate rational knowledge of the world, the standard set up by our knowledge of space is what governs our desire. Cannot the breaks, the jolts, the margin of foreignness, be exorsized from other things and leave them united like the space they fill? Could this be done the philosophical kingdom of heaven would be at hand. But the moment we turn to the material qualities of being we find the continuity ruptured on every side. A fearful jolting begins. Even if we simplify the world by reducing it to atoms and their motion, the discontinuity is bad enough."

Well, I am sure I never can comprehend that knowledge of space which would make it a standard for judging the world. Perhaps this is an example of that higher intelligence which these philosophers claim to have developed. For me it is just these breaks and jolts that we must have to secure the differences and relations which are necessary to things. A world without things, would be, what? Surely nothing to jar the tender mind of this learned professor. When we compare the view of this man with that of Herbert Spencer, the difference is somewhat striking, The one is England's greatest, the other is America's greatest. The one declares that we know absolutely nothing about time and space and the ego; and the other declares that our intelligence regarding all three, is absolutely intimate. Which is right? Most likely both are wrong.

Within the last few years another new form of Idealism has got a start in the minds of several of those above mentioned. Prof. Bowne calls it Personalism, Prof. James calls it Pragmatism and Prof. Schiller calls it Humanism. This new philosophy teaches that real things are true ideas. We know they are true because we can digest them and assimilate them. They answer for every purpose in life and the knowledge of this fact is our guarantee of their truth. So far as these people admit the necessity of the harmony of ideas, they are right, but it seems to me that their ideas do not harmonize. They admit common sense as a factor in thought but they have placed it on the lowest level of inteligence. Critical philosophy and Divine Inspiration, (the high intelligence) have got ahead of common sense. Read what Prof. Bowne says:—

"Science discovers, describes, registers the facts; Philosophy interprets them. Common Sense does not distinguish the question at all. It believes in causality but finds it in sense objects and there is no mystery about them. When this view is carried out it gives us the familiar materialistic and atheistic thought."

Wrong. When this view IS, carried out, it will give us the TRUE SPIRITUALISM. The final verdict of this professor of philosphy appears in the following passage:—

"From common sense the world of things is something which, for the present at least, exists by itself without any assistance from intelligence. But upon reflection it appears that this world is a function of intelligence in such a way that apart from intelligence it has neither existence nor even meaning. Space and time existence and self-conscious existence exaust the possibilities for us. Any other conception is purely verbal and without any corresponding thought. But space and time existence is phenomenal only, existing only for and through intelligence. Thus the claim of Personalism is being established."

When we get to be well fed on the wisdom of such teachers perhaps we will be intelligent enough to see that the world has a meaning for us. From Prof, Schiller's Humanism we get the new philosophy in somewhat better shape:—

"Truth may be called an ultimate function of our intellectual activity; as regards the objects value as true. Truth is that manipulation of them which turns out upon trial to be useful, primarially for any human end but ultimately for that perfect harmony of our whole life which forms our final aspiration."

The above passage, conveys to some extent, my own views on the harmony of ideas. (sec. 1.) Prof. James in his Pragmatism presents the new view in similar meaning:—

"True ideas are those that we can assimilate, validate, corroberate and verify. False ideas are those that we cannot."

Prof. Royce puts the problem in these words:—

"I am one of those who hold that when you ask what is an idea and how can ideas stand in any true relation to reality, you attack the world knot in the way that promises most for the untying of it." Prof. Dewey seems to hit the mark in the following:— "The essential business of logic is, henseforth, to discuss the relation of thought as such, to the reality as such. What we have to reckon with is not the problem of, how can I think? but how shall I think right, here and now? Not what is the test of thought at large, but what validates and confirms this thought." Mr. Fredric Harrison devotes his philosophical mind to the spread of the Positivism of August Comte, which means that we cannot know anything beyond the range of the physical sense. Mrs. M. B. G. Eddy has given us a curious revival of Christian Mysticism and Witchcraft, which claims that the power of mentally influencing others through the spirit sense channel, (book 2, chap. 5,) is strictly and exclusively Divine, when practised by her faithful followers, but the work of the Devil if practiced by anybody else. But it is the philosophy of Eddyism which concerns us here and this is amply set forth in the words, "Mind is all, and Matter is naught." This is perhaps the best known example of an unthinkable Idealism.

Now perhaps the reader will be able to form a correct conception of present day philosophy, from the above quotations. All of the College men above mentioned seem to recognize a reality beyond or apart from the conscious person, and that this reality may be truly or falsely represented by our ideas. Prof. Bowne regards this reality as phenomenal only; an appearance resulting from the higher development of our intelligence. Prof. James thinks that time and space, also mind, are clearly known but the rest of the external world is still a mystery, and as to the possibility of knowing more, he finds it in Pragmatism. He thinks that "the difference between Pragmatism and Rationalism is, that for Rationalism reality is ready-made and complete from all eternity, while for Pragmatism it is still in the making and awates part of its complexion from the future." Pragmatism is therefore a higher development of the intellect along with which goes a corresponding change in the external reality, hence its cloce similarity to Prof. Bowne's Personalism. Prof. Schiller's Humanism is very much the same. As to the nature of the external reality or the possibility of knowing it, Schiller offers the following:— "It appears that, strictly speaking, all we know about a thing is its accidents, and that we cannot comprehend how even its most essential properties inhere in its substance. The substance thus becomes either a needless nullity or an unknowable and can neither be experienced nor examined In this form therefore, the conception of substance has no value for any purpose what so ever, either philosophically or scientifically. The truth therefore is that the activity is the substance. A thing is, only in so far as active."

The necessity of the harmony of ideas is clearly recognized by these people, yet it seems certain to me that their ideas do not harmonize at all. Think of the idea that a thing is, only so far as active. Can we distinguish between matter and motion? I think we can and I must confess that I cannot understand how a human being, living under present physical conditions, which are indispensable to the development of a thinking mind, can get such ideas unless he is to some extent insane. But they are no worse than that modern Fad properly called Eddyism, and which assumes that the reality is nothing but Immortal mind; and that all who think of material things or mechanical laws; of sin, sickness or death; are thinking of nothing real. The truth is, philosophy has made no advance in two thousand years. It is the same old story about the world beyond sense, handed down in ever changing form. Many people think they know all about it for they have got it direct from the Supreme. Others declare that we know nothing, nor can we ever know anything about it. Others again, are hoping, and some are actually looking for a final solution of the problem. These last named are the Apostles of Realism, Rationalism and Common Sense, and we will now consider their view of the situation.

8. COMMON SENSE PHILOSOPHY:— Let us start with a clear understanding of what we mean by common sense. To my notion it is that native judgment faculty, possessed to some extent by all men, and which has grown up thru the long continued past experience of man, in and thru the direct contact of his mind, with this world of matter and motion; and which has been permitted to develop and mature itself under physical conditions alone. It is that horse sense which gets into a man thru his most intimate experience with the real nature of things, in the world about, and which has not been educated out of him before he has learned its use. The man of common sense does not set up any standard of thought for the world at large. The question with him is, how shall I think right, here and now. It is the very essence of common sense to be alive to the present needs or wants. If experience in physical life can teach us anything it must be this: be careful; see what you are doing; think right, here and now. All accidents or mistakes are a constant monition to common sense, and in this experience we learn its value as a safeguard. It seems to me utterly impossible that a mind could think right, or be a guide to right conduct, unless it were possible to think wrong. It is only in the experience of both right and wrong that we learn the right. And whence or why is that something which we call right, and which is so necessary to our happiness? Of course it is the external reality; and to assume that it was not made for us, that it has no existence independent of us and that it is a mere result of the growth of our intelligence, is to make an assumption very little short of ridiculous. The practical thought of every man every

day of his life is the thought that brings success, no matter what he does, or when or where on earth he lives; and this is common sense. Education, if of the right kind, may help us to use this faculty, but it can never give us anything better, and the reason is, as we shall see, simply the truth that the external reality is a predetermined arrangement of an everlasting material, expressly for our good. (sec. 51.)

Let us take the widest and deepest view we can of this question. Between the mind within the brain and the world of things without, there is the one and only avenue of sense called the physical. Thru this sense we learn all truths about things and their relations; which we call the mechanical and mental properties of matter. We also learn, or obtain, all our false ideas from the same source. On these true or false ideas we build all our philosophies, all our social ideals or religions, each and every concept that can be imagined or reasoned out, good or bad, true or false. No matter what we build it must rest on this foundation of Materialism; for there is nothing else but empty space. The utility and truth of what we build will depend on how we build; how we begin the work or what we select for its foundation. And all this selection and orderly arrangement will depend on how we think; in other words, how or whether we select and combine our ideas of things with a view to that harmony and consistency which does not ignore the great world of physical fact. Every builder in brick, stone or wood, knows how necessary it is to make sure of a good solid foundation by getting the right material in the right place, and above all to secure exact conformity to mechanical laws thruought the finished structure. But not so with the builder of the philosophical, social or religious edifice thus far in the worlds history. He does not seem to know that a foundation is necessary, nor does he seem to entertain even a thin suspicion that all his lofty aircastles of Idealism must go down in ruin because they are not solidly based on the universal mechanical laws which are necessary to life.

The truth is, all these builders of world conceptions have built on this foundation of materialism without knowing it, and they have got things mixed. Let me show just how this is. In all business pursuits common sense is indispensable for the simple reason that all lines of business are so intimately connected with material things, so purely physical thruought, that it is next to impossible to succeed in any business without such knowledge. The succesful man of busines is always one who has worked his way up thru actual sense experience, either directly with material things or with their representaton in figures. When we speak of business pursuits in the widest sense we are covering the whole sphere of human occupation in physical life.

It is everybody's business to enjoy life and to be engaged in something which contributes to such enjoyment. When we canvas the whole ground of human occupation in physical life, we find absolutely nothing which does not belong either to the physical world without, or the mental world within; which mental world includes all mind. It is plainly obvious that this mental world has been created in the experience of past and present life, and thru its direct contact with the surrounding world of matter and motion. To say it was given to us by the Creator does not explain its origin unless we suppose that God has placed before us a world of forms of matter and motion as original patterns for the making of our ideas of things. This, so far as it goes, is the most satisfactory explanation from the common sense way of looking at things. It seems impossible to avoid seeing how completely dependent the mind is, for all its objective forms, on just such a world. The careful student of physical science will not fail to see this.

Now, so far as careful sense experience is concerned, our mental world may be an exact copy of so much of the physical world as comes within the range of the physical sense. This is the proper sphere of physical fact upon which all sound judgment proceeds, and the fact that there is such a thing as sound judgment helps to prove that there is such a thing as an external physical world which is just what it appears to be. The exercise of such judgment is simple common sense. Now, these same physical facts, derived from the same material objects in the same sense experience, may be combined by the individual mind itself, into the most fanciful or impossible systems that the wildest imagination can suggest. Thus the same sphere of physical fact is the necessary foundation for not only the most thorough going reason, but the most groundless imagination. And so we have the evidence of the materialistic origin of not only all the conceptions of Realism or common sense, but also all the false conceptions of Idealism or Religion. From this point of view, whatever is false in Idealism or Religion is simply a departure more or less, from common sense.

We begin our speculations regarding the unknown in common sense, in fact we cannot even begin to live without it, because all life must begin its independent existence with some real knowledge of the external world. The further development of common sense gives us Applied Science. From applied science we gradually pass into Theoretical Science, and this leads directly into the true Philosophy; on which we can base all higher developments of Sociology and Religion. All these are only different names for the different stages in the development of common sense; in fact, it is common sense all the way thru. It is a plain, straight road which leads to the goal of a perfect theory of life and any one may follow it if they are careful to keep on the bridges which span the numerous pitfalls.

In books on logic we are told that the three primary principles of logic are, (1), the principle of Concistence or Necessary Truth; (2), the principle of Deduction; (3) the principle of Induction. If we mean by consistency or necessity, the practical value and need of truth, as we find it in life and as presented to us in our true ideas of things, then for a fact concistency is the one jewel in the crown of a true science of logic, and it must be indispensable in the pursuit of real knowledge. An what is this but common sense? The practical good sense which everybody knows to be good, because in the practice of it we always get along the best, and which is obtained only in the experience of physical life, is what we mean by this word. And that consistency runs thru it all, is evident at every turn. We see it everywhere in the necessary relations of mind to the external world. And seeing the ultimate possibility of the harmony of all things which secures the greatest good to all, there is no question about the validity of a philosophy which rests and builds upon common sense alone. To seek for a more promising outlook than this seems unnecessary.

If we take this for our meaning of the words consistence or necessary truth, it seems that this meaning would not exist without a mind to be aware of it. One thing may be consistent or necessary to another, and that to another, and so on until we reach the universe of things complete and perfect in itself; but it would not be complete and perfect in itself without a mind to contemplate its completeness and perfection, and of which it is a necessary part. There is nothing needful or necessary without a sentient being to which it is needful and necessary. The physical world in itself, no matter how complete, perfect, consistent or necessary, from our point of view, would be very far from such completeness without our point of view; and from a higher point of view it might be still more so.

The words Consistency, Necessary Truth, Agreement Disagreement, Order Confusion, Harmony Discord, Existence, Non-existence, Conditioned Unconditioned, Difference, Similarity, Transformation, Uniformity, Relation or Relativity, Time and Space, Matter, Motion, Mind, seem to be sufficient to convey all that we can have any use for in thought, science, philosophy or general Knowledge; and all of this is more or less under the words Consistency Inconsistency. The socalled principles of Deduction and Induction are different forms of inference from the known to the unknown, as concerned in speculative thought The socalled principles of Identity, Contradiction and Excluded middle; the Cyllogism and its numerous forms, canons and rules; are all seemingly unnecessary discriminations in the innumerable forms of thought. A man may be a thoroughly educated logician and yet totally incapable of approaching the question of ultimate truths. In the common experience of physical life we are able to get all the logic we can ever have any use for in this world, and we run no risque of getting our heads filled with a lot of inharmonious ideas. But we must have some method or rule of procedure to guide us in our first philosophizing steps. We must (1), realize that there is some real truth to be learned; (2), that we learn by inference or judgment from past experience with things already known; (3), that our judgment must proceed in accord with recognized method, in harmony with common sense and have the guarantee of a general law the truth of which is to some extent known or assumed.

Now it is generally admitted, or should be, that the method of modern theoretical or applied science, is also the method of philosophy. This method is called Analysis and Synthesis. By what we might call Objective or Sensible Analysis, we are able to resolve any sensible object into its smallest sensible parts. But we are never able to carry this process beyond the point where the parts cease to be distinguishable by the use of the physical sense. When the object does not admit of further analysis or resolution, we are supposed to have reached the limit, not of the process, but of our sensibility to distinguish the smallest parts. By what we might call Subjective or Insensible Analyses, we are able to carry this process of subdivision far beyond the limits of the physical sense. But in this venture beyond sense we must depend entirely on sense experience and the judgment which proceeds thereon for results. It is simply a process of inference from sensible things to things beyond sense. By this meams we are supposed to be able to reach a knowledge of the ultimates, or of a system of things which may exist beyond sense. These insensibles are properly called things the same as sensible things, but they are individually too small to be distinguished by the physical sense. Together they may be the essential elemets of sensible things or they may make up the more or less unnecessary parts of sensible things. All sensible things are composed of insensible things. In these two classes of things, the sensible and the insensible, and in all their properties, relations and activities, we may find all degrees of order and confusion, in fact all phenomena mental and physical; and this is the legitimate sphere of philosophy, science and ordinary knowledge.

By the method of Objective or Sensible Synthesis, we are able to put together sensible things, or their sensible components, and discover their true relations, their forms, properties, activities and effects upon one another, upon sensible objects and upon the conscious mind. But, as in the method of analysis, we are unable to carry this proces beyond the range of the physical sense. We may however, as in the case of analysis, proceed beyond sense by the use of the subjective or insensible synthesis, which is purely speculative or theoretical regarding the ultra-sense world. Here as in the analytical process we depend entirely on common sense; that careful judgment which can only proceed on real knowledge of sensible things. This method of knowledge is therefore both analytic and synthetic. It separates the components of a thing so far as it can distinguish them, then it puts them together systematically and in conformity to general law, so far as it is able to discover their true relations. In this way we can hope to be able to obtain reliable knowledge of the great world supposed to exist beyond the reach of the physical sense. The value of such knowledge may be measured by the way it is based on the facts of sense, by its depth and thoroughness, and by its getting down among the real ultimates and out beyond the range of sense so far as to comprehend the universal order, which must be the test for its truth and value. The object of such knowledge is to comprehend the universal harmony, consistency or necessity as inferred from that part of it which comes within the sphere of sense. The truth of such knowledge is to be found in the full realization of the universal order wherein all things have a place and a necessary part to play in the perfectionment of the whole. The attainment of such knowledge is necessarily the work of human judgment as described; and for the simple reason that our senses are limited and we cannot get beyond this limit in any other way. This is the road to the ultimate and to philosophy, and if we are not satisfied with it we must fall back on theology or be contented with our ignorance.

This method was known to the ancients and it is well known and in constant use to day, and it may be applied to both mind and the external world. We see its application in Astronomy, Physics and Chemistry, thus showing its availability from the smallest sensible thing to the entire Universe. In its application to the common things of life, into which it does not go very deep, it is called ordinary knowledge. In its application to the larger divisions of things it is called Science. In its application to the entire Universe it is properly called Philosophy. At least this is the sense in which I propose to use the word. In my view there is but one philosophy. All divisions in philosophy are correctly called sciences. Under the combined use of analysis and synthesis, sensible and insensible, we have a clear view of the object of philosophy; which is, to discover and define the general laws under which all things are harmonized. In science and common knowledge we not only aim to separate and combine things according to their true differences and relations, but we aim to discover the general laws under which they most perfectly combine, This is called in logic the method of Induction; which starts with some individual truth most certanly known and proceeds by inference to harmonize other truths under it until we are able to announce the discovery of a general law.

It may be seen from the above that all possible knowledge must lie between two extremes of thought; that which is most particular and that which is most general. The first named is that which concerns the minute details in any particular thing or affair and the last named include all that knowledge which is of thing supposed to exist outside the sphere of sense. The first is always the most thorough, or may be so, because it has the direct and constant use of the physical sense the perceptions in which, being often repeated and compared, and finally combined into ideas and confirmed by further experience until they become permanent parts of the mental organism. Here is something we should never forget. These permanent parts (in-born ideas) of our mental make up, in so far as they have been derived directly from the external world by long and careful sense experience, are true ideas. And their truth is demonstrated in and by the fact that they can all be reduced to a most perfect system; as shown in this work.

Between these two extremes of knowledge we can draw the line very plain which seperates the world of sense from the great world beyond, and it is not difficult to see which side of the fence we are on and which side philosophy is on, and how dependent we are on science and common sense for our knowledge of the things of philosophy. For a long time science has been getting on the philosophy side of the fence. All our modern theories of light, heat, electricity, etc, are theories which rest wholly on the assumption of an ether medium possessing the mechanical properties of ordinary matter. This encroachment of science upon the territory of philosophy is a significant fact. How can the sciences advance if they do not move toward the unity of all knowledge? Any scientific theory which goes beyond the range of sense experience, is necessarally an approach toward the fundamental basis of all things; and this of course is not a thing of direct sense experience.

We can fairly conclude that there is one common method for the attainment of any or all knowledge, whether special or general, common everyday information, science or philosophy. We can call this method by any new name but it is the same old common sense, which must always be just what it is, by reason of the necessary conditions under which mental action is possible. It is not inherited genius or any special gift which falls to the few, for it is universal. It is simply that common perception of real things and their true relations, with the necessary judgment which follows. It has been soaking into the human mind for millions of past generations and without which there would be no life. Its universality is plainly shown in the fact that all the animals have it in its lowest stages of development. It is a noteworthy fact that the philosophers in all ages of human history have more or less justly recognized common sense as an important factor in thought. Perhaps those of Scotland in recent times have given it more attention than those of other countries. Lord Shaftesbury has the credit of being the first to use the words now used and he also called it "natural knowledge or fundamental reason." Francis Hutcheson regarded common sense ideas as "self-evident axioms," by which we perceive at once the agreement or disagreement among things; but he denied that they are inherited. Thomas Reid went further than those preceding him. He maintained, in opposition to the skepticism of David Hume and others, that we perceive matter and its quality, cause and effect, moral good and evil, and he insisted that common sense is in the very nature of the mind of man, calling it an "original natural principle of our mental constitution, given to us by nature." He was certainly right. Dugald Stewart recognized such ideas as natural and original, and he called them "Fundamental Laws of human belief." Thomas Brown held a similar view, calling them principles of thought; primary, universal intuitions of direct belief. Sir W. Hamilton went very thoroughly into the matter and he specified many of its prominent characteristics. He made the point that the argument from common sense is strictly scientific and rational, and he produced testimonials from the writers of all ages in behalf of its true importance. Dr. James McCosh, late president of Princeton College, is the most modern of the well known writers on this line and he has contributed a large volume on the subject entitled "First and Fundamental Truths." He makes a resolute stand for this doctrine and calls it Realistic Philosophy. Among the Germans, Kant recognized the principle of common sense as innate and necessary to thought. Of our intuitions of space he says: "It must be already apriori in the mind, i. e. before there is any perception of objects." Of the French philosophers M. Cousin has offered a good statement of one factor of this truth: "Reason looks at truths universal, eternal and absolute; truths not of the individual or the race, but of all intelligence and therefore necessary." Berkeley attempted to reconcile his system of immaterialism with common sense. He was afraid the common people would not understand him. The modern Idealists have shown a little respect for common sense but they place it on the lowest level of intelligence, and it seems clear to me that they have failed to understand it.

4. **Political Philosophy.**— That the cure for all political or social evils, is conspicuous and open to the common sense of all men, seems as clear to me as any other question in this problem of life. Like all questions, this is a question of philosophy; and a complete solution of it may be found in a complete Philosophy of Things. Here I shall only call attention to one fundamental truth of all social phenomena; leaving the rest for book 2.

Not only every thing that lives, from the simplest up to man, but Sociity itself, in all its aggregates so far as they conform to the law of association or mutual dependence, is a Mental Organism. The plan and ultimate aim of this organization, is the same for animal, man or society. A comparison of the social organism with the mind and body of man, has been attempted before. It appears in Plato's model Republic, in the Leviathan of Hobbes, and Spencer has given it some attention. But the mental organism which I shall offer here is different. It is purely a mental organism in itself, in its relations to the body and to the physical world, also in its governing laws. It is nothing but mind. The physical organism or body, (which is composed exclusively of forms of matter, the activities of which are forms of motion, which, when not governed by a free mind are governed by the laws of motion which we derive from the inertia of matter, chapter 3) is not a part of this mental organism because it is not mind. This distinction between the mental and physical worlds, so far as I know, has never been made before.

In chapters 2, 3 and 4, book 2, is described a theory of the form and mode of operation of the human mental organism; also a theory of its origin under physical conditions, which latter, is to some extent an advance upon the Darwinian theory of descent. Both of these theories apply not only to all living things, but to all forms of the social organism, which have for their object the happiness of all the individuals. According to the first named theory every individual mind must have a center of self consciousness in which all the elements of the complete individual are united. Under this higher center are a number of similar but subordinate centers, and under these again a larger number of still lower subordinates, and so on down to the simplest units of life. These smallest units of life as well as all the higher aggregates of them, are not biological units in the ordinary sense of that word, but psychological units in the sense that each one of them is a combination of mental elements, to some extent free to control the motion of conscious matter and so to act independent of physical laws. In book 2, it has been explained how the conscious individual mind is able to control the motion of the conscious matter of the brain and higher centers, as in ordinary conduct. Thus every thing that lives, from the smallest body cell or independent germ, to the most highly developed human personality, is a mental organism possessing a limited degree of mental freedom or power to control the motion of its own substance. In the normal, healthy and well balanced mind all the subordinates are in their proper place, each lives its own active life and performs its work for self and the others. Mutual dependence is so true of the community, that the active life of any part would be impossible without the active life of all the other parts. It is a simple case of the association and cooperation of the individual units which make up the mental organism of a man or a dog; and upon which depends the life of the whole or of any part. Almost exactly the same may be said of the social mental organism. No man can live or even begin life wholly independent of some form of society.

A few of the points of similarity between the person and the society are the following: (1), Each part of the mental organism must occupy a definite body or portion of matter, over the motion of which it must have some control, in both the person and the society. (2), Each lower part must be to some extent under the control of a distinct higher part, and so on to the highest, in both the person and the society. (3), Each part must be connected with all the other parts so that there may be a free communicaton from one to another thruout the community, in both the person and the society. (4), Each part must be capable of performing a different and necessary part of the work, in both the person and the society. (5), All the parts must be more or less closely united under one highest, controlling, self-conscious, and to some extent self-controlling part, which is the outward manifestation of the complete individuality of either the person or the society. (6), The sole purpose of this association of parts or mental elements, under one control, is to secure the highest possible state of agreement conductive to life and happiness for every part, in both the person and the society.

Thus the parallelism between the person or individual and the society on six points seems conspicuous. But there are some differences between the two, which however, signify nothing so far as political philosophy is concerned, but they are interesting as truths of mind. Both the individual and the society must occupy definite bodies of organic matter which are subject to physical laws in so far as they are not controlled by mind, and which bodies are divided into parts; but the parts of the individual are more closely united and less capable of independent life than those of the society. Being more simple and less developed, the former are less able to perform the great variety of activities peculiar to the parts of the society. In the society the parts, or individuals as social units, may be completely detached from the social body without destroying their life, but not so with the parts of the individual. The parts of the individual are united through the spirit or purely mental sense (book 2), while the parts or individual units of the society are united through the ordinary physical sense, which employs matter and motion for its medium of communication.

These seem to be the principal points of difference between the individual and the society. The parts of the individual all inhabit one body, the parts of which are closely united yet distinct, while the society is simply an aggregate of the same individuals not so closely united, but to a great extent mutually dependent. The parts of the individual live in a small spirit world limited to the size of the material body and in which they are governed by the mental law of association, while the units of the society live in a much larger physical world in which they are subject to physical conditions. The thinking and acting center in the individual is not only a controlling center but a necessary point of union of all the subordinate parts, and its existence is absolutely necessary to the existence of a mental organism; and without which life is impossible even for the simplest thing that lives.

Now, in the social organism this highest controlling part which thinks and acts, is just as necessary as it is in the individual. But in the society it must be an individual,—one or more,—instead of a part of an individual. This social head we call the President, the Governor or the Boss, according to the extent and nature of his dominion. He is the chief magistrate at the head of the government, which government is necessary to maintain the social unity and harmony. In the individual the governing element always contains two parts, the thinking part and the acting part. In the society the governing head also contains two parts, the legislative and the executive. But in the social head these two functions are not vested in one individual. The governor of a state or the president of the United States is the executive head while a number of other learned men form the legislative body. The legislators are supposed to make the laws and the chief executive is supposed to enforce them. The object of the law is to secure good government; which the majoriy of the people are supposed to want.

But what is good government? We can find the answer at once in that knowledge of self and the world which will enable a man to maintain health and happiness under physical conditions. Such knowledge with self-control is all we need.

The laws which govern the relations of the parts of the social mental organism are precisely the same as those of the individual. But in the society they are more simple, more conspicuous and much easier to understand;—so much so in fact that in our study of mind we are greatly aided by our study of social phenomena. It is not necessary for us to wait a thousand years, or even one year, for mental evolution to bring us to the scratch from which we can understand these laws. The common sense of this age can understand them now and we must understand them in order to know what good government is. The mental and physical laws which have brought about the present association of the parts of the individual mind have also brought about the present association of the parts of the social mind. The whole problem has its proper place, both evolutionary and as it now stands, under the mental laws of ASSOCIATION, ACTIVITY, AGREEMENT. Everyone knows that our present and most desirable associations, physical or mental, are those which contribute most to our happiness on the one hand, and those which enable us to avoid pain on the other. In the individual the capacity of each part to perform the work and live the life which promotes the highest state of agreement among all the parts, means health and harmony within the body, and this is the association of parts which long ages of natural selection and survival of the fittest has brought about. In the society the capacity of each person to preform the work and live the life which promotes the highest state of agreement among all the people means health and harmony within the social body, and this is the association of the people which through ages of selection and survival has given us all that's good in our government.

There is nothing more simple than this principle of government or social relations, and perhaps there is nothing about governments better known and yet more ignored or overlooked than this principle. It will be seen that this form of society rests upon an inexorable law of the human mind; in fact all mind. It has come into being through the life experience of ages past under the necessary physical conditions prescribed in the principle of Mental Evolution and it has raised human society from the lowest levels to its present higher level. It is still at work for the good of mankind and it is a good thing for us to understand it.

A good government, therefore, is simply that social state in which each person gives to society, with good intent, all he is worth to society, and receives in exchange a just compensation.

In the administration of this form of government it will only be necessary to determine who is able to work, what the work of each person is worth to society and what shall be a just compensation. Paupers, lunatics and aged persons who are not able to work will be cared for by relatives or by the state. The state is the government and every person is a part of the state. The state owns everything within its boundary lines and every person works for the state. The private ownership of anything of value to the state will be limited to what a person can earn lawfully during life. When the person departs this life his or her estate will revert to the state except such articles as are valuable as heirlooms, keepsakes, etc., which may be willed to relatives. Since the wage scale is determined entirely by the value of the work to the state, the millionaire will not exist, because no person will be worth that much to society. The person who gets the best wages will be the efficient executive, legislator, manager, and above all, the person who possesses the creative talent which enables one to produce something of great and lasting value to the world. If a person can paint a picture worth a hundred thousand dollars, that sum will be his to use for life, and so in all departments of skilled labor. The person who creates will be rewarded; the person who accumulates by cunning business methods will have no opportunity to thrive. The able bodied person who refuses to do any kind of work will be permitted to starve. This is a co-operative system throughout, and it is exclusively voluntary. There is no compulsion in it. Going back to the foundation of all life we find that everything that lives must do something, and must know how to do it, in order to live. The man who would rather be dead than alive might call this fundamental law of life compulsion; but the great majority of those who want to live would call it voluntary.

Taking this view of the matter the next question is, are we now living under a good government? It seems impossible that any intelligent honest person can say yes, in answer to this question. Human history contains no record of a single example of good government on a national scale and after the above model. In view of the wonderful simplicity of the problem this is a significant fact, and why is it so? There are several reasons, primary and secondary, or necessary and unnecessary, as follows:

A primary and necessary condition of all social life, is, that it must contain evil during its evolutionary stages, in order that good may triumph in the end. In all the struggles of life the good things are gained through experience of the bad, and we must have this experience in order to learn. In this life money represents the value of nearly every good thing. Perhaps the only exceptions are intelligence, moral character and the air we breathe; but even these must be obtained through some experience and sometimes the experience is costly. For the air we breathe it is only necessary to work our air pumps, and perhaps this is the cheapest thing in life. The representative value of money has made it not only the means to all the good, but the root of nearly all the evils of society; certainly all the practical evils. Everybody wants it and must have it to maintain life and happiness, and it is in the practice of getting money that every man shows his character. The line which separates the honest from the dishonest practice, is very plain to all men; at least in the common affairs of life. But it really seems that the great majority of men the world over and in all ages, do not understand that there is a moral limit to the attainment of wealth. For all who rightly view the facts there cannot be the slightest doubt but that the possession of too much money is a crime against the laws of God; for it encourages men to live in that inhuman way which thwarts the plan of Evolution. The man of great wealth never takes kindly to the doctrine of Social Evolution, perhaps because it threatens the end of the present system of government under which he has gained and now holds his wealth. He is apt to regard himself as superior to the common people and worthy of a higher place in society. But no man has ever made a greater mistake. Of all the traits of men, there are none that prove his animal origin more decisively, than his inordinate craving for money; and what is it good for? Apart from its purchasing power money has no value and even thru its purchasing power what can it do for us but provide the few things we need in this life. It gives us no special faculty nor anything whatever which makes for higher intellectual attainment. It is the chief incentive to everything base and mean in the character of men. As an inheritance it is more dangerous than a bad disposition, because it often makes a fool and a criminal of a man by depriving him of the discipline of a natural life, which is only possible without it. He fails to learn that the only praiseworthy ambition in this life, is that of service to God and Man; and that the only deserved compensation, must be that for faithful service rendered. That the bad examples set by the richest men of the United States has had a demoralizing effect upon society, no one can seriously doubt. Their methods are known and practiced everywhere by all who want to get there as they did. If such a man could purchase everything he needs in this world for a dollar he would have no use for another dollar, but would he be satisfied? Not much. If some one else had two dollars he would want three, and he would go to the extreme of miserly meanness to get it. These people work and cringe to their god of mammon, accumulating dollars on dollars, soaring high into the hundreds of millioins, far more than the most extravagant man could spend in a thousand years, laying elaborate plans for the future in costly mansions and furnishings, all for themselve, just as tho they expected to live right here always, and then they die; almost before the begin to live and certainly before they begin to understand what this life really means. It is sad to think that all these millionaire mammonites will be dead in a few years and remembered by a greater humanity only to be pitied as unfortunate beasts whose swinish habits got the best of them and made them miss the only road to real achievement. And it is more sad to think of them hoboing around in the next world without a cent; God-forsaken and wretched.

This is one, and perhaps the principal one of the primary and necessary evils of society. But the evil is not in the money nor is it in the things for which the money is the medium of exchange. It is all in the ignorance and moral depravity of the social body. A striking trait of all animals and to a great extent of men, is self-interest as against the interests of society. Society has always been divided into two great classes. On the one side is the Aristocracy, the Hamiltonians, the worshipers of Mammon, the social Parasites who produce little or nothing for society. On the other side we have the Common People, the Jeffersonians, the Working People, the real Producers. Conflict between these classes has never abated for a single hour in all the history of mankind. It is an astounding fact that we have always lived in an atmosphere of agitation and strife over the question of an equitable division of the things which all men must have to sustain life, and this too in the face of the truth that God has given us a world which might support ten times its present population and no one need suffer for anything actually needed. But more astonishing than all this is the fact that the remedy for all social evils, the true principle of all governments, is now known to the world and has been known and in constant use ever since man appeared on this planet. It is even known and practiced to some extent by the animals.

The word ORGANIZATION, conveys this most indispensable principle of life, better than any single word known to me. It is the arrangement of the parts or departments of an aggregate or body of individuals, for that form of work which aims for a definite object. Political or Social Philosophy rests on the fundamental truth that Society or Life, is, and must be, a Mental Organism; a combination of mental elements or individuals, organized and active under the three secondary laws as follows:

1. Association: Any conscious state, in man or animal, is possible only in the union of a number of mental elements which cannot exist alone. For the same reason no man or animal can live absolutelyalone, not even in a world of abundance like this. He must have the help and the society of others of his kind.

2. Activity: Every mental element in the combination upon which consciousness depends, must have an independent activity of its own, and this activity or consciousness must be directed to a single external object thru a self-conscious center, which center is the point of union of all the elements of the conscious individual. This is the mental organism in its simplest form and

it must be present in every thing that lives. For the same reason every man or animal must be active in some way in order to maintain life and happiness. This activity and consciousness is always directed to a single external object thru a self-conscious center, which center is the point of union of all the elements of personality. It is thru this center that the self-controling and energy directing faculties of the person or animal are exercised, and in this exercise we have an example on a small scale, of the principle of organic government in actual operation. All men who are not incapable of action must do something; not for self only, but also for the great social body of which they are a dependent part and without which they could not exist. To do for society is to deserve the help of society, and every man's capacity to do, is the measure of his reward. Decency asks no more.

3. Agreement: The mental elements of any state of consciousness, in order to give rise to an agreeable, happy or satisfactory state of mind, must act together in harmony. When there is discord among them the state of mind is not pleasant tho consciousness may be just as vivid or even more so. When there is work to do the mental elements must act together as above shown, but in this case there is less spontaneous activity in them; hence they must be influenced and controled by certain higher elements or faculties called judgment, self-control, will, etc. These faculties or powers of mind constitute the administrative function of the government which presides within the individual man or animal. It will be seen that such governing power can be exercised only thru a center which brings together all the units of the individual, and that this is, strictly speaking, a self-governing mental organism, which aims for the harmonious activity of all its units, cannot be doubted. Now these same individuals, men or animals, are the necessary units of the social organism; which, in itself is also a mental organism, governed by exactly the same laws and for exactly the same purpose: agreeable relations.

This principle of organization has been thoroughly discussed and amply justified in book two. I would regard it as the true foundation of any system of government or religion which aims for universal agreement among men.

5. RELIGIOUS PHILOSOPHY.—True religion, says the modern church, rests on "divine faith". Divine faith is the undoubting assent which we give to revealed truths; not because of the evidence for them, but because they are revealed by God. The church is the infalliblble means of knowing what these truths are which God hath revealed. True religion says modern philosophy rests on an unknowable absolute. "The power which the universe manifests to us is inscrutable", and this is our God.

True religion says Common Sense begins here on earth, not as a revelation from God, but in a knowledge of the true Materialism. We must know Matter before we can know Spirit and each one must know Self in his true relations to the Universe as a whole, before he can know God.

In every act of faith some object of belief is implied. To be faithful to a pledge or duty, is to believe in the reality of the object of faith; or to give undoubting assent to what is stated or put forward by another, is to believe in the truth of the object implied. There never was and never can be a grain of faith in human thought, without some object which is believed in as real or possible. The dependence of belief on evidence or reason is equally conspicuous. There never was and never can be a grain of belief about anything divine or human, which has no object nor any reason or evidence for the belief. There is no faith without belief, nor belief without evidence of some kind as necessary to the faith; and any assumption to the contrary has no warrant in human experience. All faiths or beliefs and all evidence in support of them, are the proper subject of knowledge and judgment.

The great question at the bottom of all the religions of the world, past, present or future, is a simple question of knowledge and judgment. Every man's judgment must depend on his knowledge of things and his ability to judge rightly; and every man's religion must depend on his judgment.

The fallibility of human judgment is a conspicuous truth of all history not excepting the history of religion. The same complaint against the most of the philosophers may be urged against the majority of the makers of religion. From the beginning very many of the founders of religion were also philosophers; but they were supposed to be of a select clan endowed by the God's with special powers and gifts, and they got their information about the world and the destiny of man direct from headquarters and so were spared the task of working their minds to get it. For more than six thousand years these self-appointed agents of heaven have been laying off the boundary lines of human knowledge in this direction, and pointing out the only roads to God. And like the would-be philosophers they have always made their limits to ultimate knowledge, and their highways to God, to correspond exactly with their own ignorance of the world and their bigoted views of life. The history of both philosophy and religion is now of more value to the student than any one system of either that might be named. We can learn from it the strong probability that all these systems are the work of men, and we can learn to a certainty that the human mind as a unit, has never been able to accept a single one of them. We can learn the truth of this greatest of human aspirations for the truth, and best of all we can learn to distinguish between the two roads in philosophy—the one which leads by patient human effort to the truth, however little at a time, and which makes a real philosopher of the man; and the other, which jumps at conclusions here and there, wildly floundering in the air, building castles of ideas fair, and which makes an educated ass of the man.

There has always been an open rebellion against the dictum of philosophy and religion and there are millions in the world all the time who are ready to break down old lines simply because their good sense tells them that not one of the present systems give them promise of complete satisfaction to all classes of men. It is now very generally admitted that the world needs a new and all-satisfying religion and that the universal religion must rest and build upon a finished philosophy which can furnish a satisfactory solution of ultimate problems. This work will gain its object if it succeeds in laying the foundation for a future religion that all may accept. The first step in the better way will be to cease to make assumptions about·that of which we know nothing, and to pay attention to common sense and to the things which we know something about. Next, we will draw the line clear and sharp between the true Materialism on the one side, and the true Spiritualism on the other; and make it plain that a knowledge of both is indispensable to a knowledge of either, and that the modern church in its ignorance of both, and in its inexcusable indifference to this most necessary knowledge, has become a gross and corpulent body of inert and one-sided materialism; and this too without knowing it. But some one will ask: How can we destroy this modern monster which continually thwarts the progress of rational religion? The answer is as easy as can be. Simply realize that the God of Nature has prescribed a most perfect course, in the material conditions of this life, for the growth and maturity of the faculty of Rational thought in man; that Physical Nature with her Material Forms and Mechanical Laws, has been constituted just as we find it for the express purpose of affording to Mind an objective reality of Things, upon which it can exercise itself and develop through sense experience, as required under the law of Mental Evolution, and that this most needed course is constantly being hampered by so much of that one sided spiritualism which is proclaimed as the word of God.

One of the unmistakable signs of physical life is this:—God has never intended to reveal his Creative Plan, or anything else, to us. To do this would be to oppose the very object of His plan, which object is plainly manifested in the order of the World; and he who looks for it may see it. And even if He had, we should expect Him to have given it to us in a more intelligible shape. The truth is, we are here to find this out, every man for himself and by the use of his own common sense. We have got the faculty by the wise administration of Him who does things well, and now let us use it. This is by all odds the most reasonable view when we consider the facts. How could we reason if there was nothing to reason about? We can only admit at the most, that God may have given us a hint here and there, just to stimulate our curiosity and make us reach for more knowledge. To reveal all the secrets of Nature at once would be to take away our job and leave us in idleness, and idleness means degeneration and death.

Another unmistable sign is this:—Man was not brought into this world for the sole purpose of worshipping a God. This idea of worship belongs to the early ages and lower stages of mental growth and has now outlived its usefulness. Our worship should be that of practical service, and we can serve the Supreme in a thousand ways more becoming and helpful to us and no doubt more pleasing to Him, because it seems certain that His will is human progress. We all want the blessings of life, and we pray, and fuss, and make a great noise, trusting in Him to grant our desires and not forget good measure; and all this time we are forgetting that He has placed us here to work for these things, to carve out our own true philosophy, our religion, our theory of life; in short to discover the whole truth and do it by intellectual effort alone: and when once we have the truth to make the best possible use of it. What profit is there in thought, and how did we get this habit of thinking? Undoubtedly the best way to make a man think is to give him something to think about and place him where he will want the thing he is thinking about and will have to think in order to get it. It is the thinking that makes the man and this no doubt is God's way of making men.

No one will find it difficult to understand that peculiar sentiment of the religious mind which prompts men to inscribe on their altars of worship, the words:—"to the unknown and unknowable God;" or the words:—"a God understood would be no God at all, and to think that God is, as we can think him to be, is blasphemy." This is undoubtedly that miserable credulity or blind veneration for an object, which object can be nothing but a creation of the undeveloped and scared mind of the child-man who ought to be dead long ago. It is faith in something admitted to be unknown, assumed to be unknowable, and concerning which knowledge is not even desireable. If there is any thing that deserves to be called insane superstition it must be this. Now the foremost philosopher of modern times has declared that this degrading superstition is the vital element in all religions. It is the soul of truth which begins in the most ancient, survives all changes and grows more distinct the more highly the religion is developed. "It pervades all the cultivated theology of the present day" says Spencer; and he ends his remarkable chapter on "Ultimate Religious Ideas" with the following passage:—

"Here then is a truth in which religions in general agree with one another and with a philosophy antagonistic to their special dogmas. If Religion and Science are to be reconciled, the basis of reconcilation must be this deepest, widest and most certain of all facts—that the Power which the Universe manifests to us is inscrutable."

Spencer did not recognize this common element of superstition in religions generally. He has done a great service to philosophy in pointing it out and showing it to be a like truth of religion, science and philosophy—a perennial truth which is passed on from generation to generation. He distinguished it as the "soul of truth" in all human beliefs—the Power which the Universe manifests to us, and this is all he says about it. Now it is well known that while science and philosophy both recognize this power as an object of profound interest and study, neither one have ever regarded it as an object of worship. To do this would be to make an assumption directly antagonistic to one of the oldest of scientific precepts, and right here is where all the religions differ from science and philosophy. The soul of truth in religion, therefore, is not the same as that in scientific philosophy. It may be the same thing, but it is not regarded in the same sense. To the one it is an object of worship, veneration, superstition, an excuse for all forms of dogmatic assumption. To the other it is an object of great mystery—something for human investigation and possible knowledge.

By taking this view of the matter we can readily distinguish between what is science and what is religion. Scientific beliefs must rest on evidence of the most undubitable character. If they are not supported by such evidence they are not science, and any philosophy which is not wholly made up of the truths of science is not philosophy. Religious beliefs, so far in human history have rested on various assumptions about this unknown Power which the Universe manifests to us, and in so far as this power is regarded as an object of worship, the superstitious character of such worship or religion, must be admitted, simply because it is the worship of an object, of which we know nothing but the fact of its existence.

The fact that the religions of the world have assumed so many differet forms and that there is much disagreement among them, proves that all are not right. It seems clear to me that when we have found all the points of agreement among religions generally, we shall then no doubt have, from common sense, a clue to all that's true and good in religion. All seem to recognize the unknown power which the universe manifests to us. But not all and most likely not any, of the churches today, can admit this element of superstition which is almost the only foundation of their faith. A groundless belief in supernatural agencies which are known to be wholly beyond the pale of science, is enough to satisfy the highest aspiratins of the average Christian. This is not true Cristianity. We cannot accept as true any statement in the Bible until it has been proved by accredited science. It is my object in this work to make it plain that there is a true Christianity, clearly set forth in the Christian Gospel, and that the truth of which can be demonstrated by science.

The Christian churches generally assent to the truth and necessity of the moral law as set forth in the first commandments. But in the present state of our knowledge of God, is there one man in the world today who can keep these commandments? It is possible no doubt, that any person, in whom imagination is the ruling element, can love and worship a self-created image, supposed to reside somewhere above the clouds. But is this God? No; it is nothing but a modern form of idolatry, and not only human reason but even the Bible has condemned it. Far back in Jewish history, in the "Third Book of Moses." we read:

"Ye shall make you no idols nor graven image, neither rear you up a standing image, neither shall ye set up any image of stone in your land, to bow unto it: for I am the Lord your God."

But the Christian world is still making and worshiping images of God, and since they do not know Him what else can they do? It seem certain to me that there was but one man so far mentioned in world history, who really possessed a knowledge of God, and this one was Jesus the Christ; the first born of the Spirit of God, and who lived in the flesh in Galilee, in the first years of the Christian era. I quote his words:

"I and my Father are one. * I know him: for I am from him and he hath sent me. * If I honour myself, my honour is nothing: it is my Father that honoureth me; of whom ye say, that he is your God. Yet ye have not known him; but I know him: and if I should say, I know him not, I shall be a liar like unto you: but I know him and keep his saying."

An unknown God is not, and never can be, an object of love. To love Him in the true sense of the word, is to know Him and all things. To love thy neighbor as thyself is to know the whole truth about man and life. "Know the truth, and the truth shall make you free." If it be denied that these sayings are true it is still possible to prove their truth by a last resort to generally recognized methods of Science and Philosophy.

CHAPTER SECOND.

THE EXTERNAL WORLD.

6. THE FIRST THING KNOWN.—In Chapter I, we have reviewed the principal characteristics of philosophy under five heads, and in view of its utility as a means to knowledge. In this chapter we are to take the next step towards the object of this work, which is a knowledge of fundamental truths.

What do we know with the highest degree of certainty? It seems that the philosophers have already answered this question, to some extent at least, and so far I must agree with them. My own state of consciousness, in which I am awake and thinking about something, are to me the most real and best known of all the things of which my knowledge consists. When in this conscious state if any one should undertake to convince me that I am not conscious, it would be necessary to make me think that I am not thinking; and if they should succeed, then of course, I would be a fit subject to think or believe anything; and totally unfit to think with common judgment about anything.

But if I know that I exist, then what else do I know? or, do I really know anything else? This is the next question and it seems that right here is where all the philosophers have met their fate. They have either failed to answer it or they have declared it to be unanswerable. The history of philosophy reminds one of a little child learning to walk. The child is first able to stand alone; but when it tries to make the first step it falls down. So with the philosophers past and present. They all know that they exist, and on this they are able to stand alone; but when they make the first step toward more knowledge they invariably fall down. "The only thing I know is this thing I call self." This was a wise saying of Socrates, and it has been a leading string in the banjo philosophical to the present day. We suspect that there is a vein of vanity in such ideas when we consider that vanity takes any direction which makes it noticeable. We are vain of our ignorance; we are vain of our knowledge; we are vain of our nice clothes and manners and good looks, and sometimes we are even vain of our meanness. The professional hobo will often take great pains with his toilet in order to make more conspicuous his filthy rags and vagabond appearance.

Now, I firmly believe that this first step has already been made by millions of common sense people in all ages of human history. They have known the truth all the time, but they did not know that they knew, and they don't know it yet. We must know how we know, in order to know that we do know. Before I was fifteen years old I was sure that I knew the whole truth, but wanting to be a little more sure it took me a long time to find out just how. Even the philosophers have all had glimpses of the truth, but the moment they see it they tumble into one of them kerniptions from which they never recover. Emanuel Kant saw more clearly and explained more fully than any one ever before, that our ideas of time and space are a prior principle of thought, always in the mind and without which any thought of any thing is impossible. He simply meant that we cannot think about any thing, not even self, without thinking of it as being in time and space, and I cannot imagine how anyone can fail to see the truth of this proposition. But it seems that Kant could not see that our ideas of time and space are representatives of an external reality, and here he fell into that state of confusion of ideas which has been the fate of so many others. He thought that there is no external time and space related to existing things as they appear to be.

It is conspicuously true that we cannot think at all without thinking of things, and the things must be thought of as existing in time, or as having some duration in a past, present and possible future, and as existing somewhere in space. When I think of myself I am obliged to think of at least three things all at once, and these are time, space and self. The moment I ignore either one of these I fail to have a clear idea of myself, Now, I am not time; neither am I space; hence I must be something, that occupies time and space. The only idea I can have about any time and space occupant is that common idea which everybody has about matter or substance. But I cannot think that there is nothing in me but substance. This body or brain of mine can think and feel and this is my mind and mind is not matter. I can also see very plainly that in order to think I must act. This body of mine moves and its movements are necessary to my life, and I know that motion is neither matter nor mind. Here I have five things or objects of thought, and in order to have a clear idea of myself I must have some idea of all of these at once. They are Time, Space, Matter, Motion, Mind. If I ignore a single one of these I fail to understand how or why I exist. It is simply a question of clear distinctions and relations, and when we realize this, and recognize the five truths above mentioned, we then know the very conditions under which existence is possible.

So the first thing truly known in this world is self in its necessary relation to time, space, matter and motion. When we know these simple things and their relations, and when we can see the absolute necessity of all of them, then we do know that we know something, because we are beginning to see a reason for our knowledge. But this is only a beginning. It is thus far a self-evident truth which can be accepted as a trustworthy basis for further research in philosophy awaiting complete verification in a complete theory of the Universe. This, if anything, is our starting point for a right induction which may lead us to something which deserves the name of philosophy. It is a plain case of necessity that knowledge and happiness, here and hereafter, must depend on starting right in our quest for the unknown. It is not only necessary to know that we are conscious, but how and why we are conscious—all the necessary conditions under which consciousness is possible.

Now, I am perfectly aware of the fact that perhaps two-thirds of the people who read the above, in particular the educated philosophers, will not accept it as the foundation truth upon which to build our Temple of Knowledge. So I am prepared with a long and thourough argument, the result of many years of hard thinking, which, it seems to me, ought to convince any ordinary person if he is in his right mind.

7. THE LAW OF THINGS.—So far I can feel perfectly safe in the belief that I do exist and that I could not exist without being a body of matter occupying time and space, and able to move and think. But I cannot believe that I am the only thing in existence. I seem to be keeping company with many other things, hence I am disposed to ask, what are things? To be conscious at all I must be conscious of things, and it seems certain that, to know one thing from another, I must distinguish the one from the other. That which makes it possible to distinguish things is always present in every state of consciousness. First and always, it must be present between self and something else, and second, it must be present among all the objects of which self is conscious. Careful analysis will always reveal the fact that this most necessary element upon which all distinctions rest, is nothing but the ordinary DIFFERENCE which we always perceive among things.

I have tried to give special emphasis to the last statement above, because I believe it to be an apropriate presentiment in words, of the deepest and widest truth in philosophy; and because I am afraid that perhaps nine-tenths of the people will not see anything in it. The philosophers have never seemed to have any use for this word except as it happens to appear in ordinary discourse. To my knowledge it has never been recognized as the proper name of the primary law of being. Everybody seems to think that there is something more in the nature of things which we cannot distinguish and know by a sense of difference. Well, if there is, how can we know it if we are not able to distinguish it from other things; and on what can a distinction depend if not on difference? Speaking for myself, I am not able to think of anything which can be in anything, and yet not be the thing itself, unless it be that something in which it is necessary to create difference in order to create things. This view of the matter can be illustrated in several ways and here is one. When we consider the origin of human language, we find that all language has come into existence as a consequence of the existence of things, and as a necessary means of conveying information about the things. Necessity is conspicuous here. To have minds one must think, and to think we must have things to think about. We also find that all language consists in sounds or words which we distinguish by difference of form. Each word is a name or a form of sound which is intended to convey a particular part of the meaning of a sentence or a discourse. Thus we have a great number of words and each word as used in common speech is the expression of a thing and a number of such things together form the necessary parts of a conversation about the affairs of life. We use these words to talk with and of course, we must have a number of things to talk about, to make it interesting. Now, if the things did not exist we would have no use for our language; in fact, our language would not exist at all; and so it seems clear that the existence of things proves to be necessary to the existence of language, and the existence of language proves the existence of things. It is simply another case of necessity like that of self and something else; and though things might exist without mind, but if they did it would be a very inconsistent and purposeless state of existence. But are the things all that exists? or is there any thing which is not a thing?

In the English language the word things is at least one of the widest and it seems ample enough in scope to apply as a general term to everything. The only exclusion to the application of this word is nothing, and even here it applies in a certain sense. Placing these two words together as in nothing-things, or nothing-something, we are able to construct a sentence which certainly seems broad enough to cover all existence. I am not able to conceive of anything which I cannot call a thing, aud which cannot be expressed by some word or sound of voice, appropriate to our language, unless it be nothing. Now, I am perfectly able to think of nothing; in fact, I find it just as easy to think of nothing as it is to think of something. But at the same time I must regard nothing, in a certain sense, as something; for the simple reason that I can think of it. And when I inquire why it is that I can think of nothing, I invariably come to the conclusion that it is by reason of the difference of the two nothing-something. This is all I can see in it—simply difference. So we have it as plain as any one could wish that, between the two extremes of nothing and all things, our language has encompassed the whole of existence, and it is all included and fairly expressed in the simple words things and nothing. And the thing which makes things and nothing is difference.

But, although we have covered the whole thing and defined its limits, we have not yet grasped the important details within these limits, and which are essentials to knowledge. The question still remains, what are things and nothing? If we can find something in them which we cannot distinguish by difference we shall then have a good excuse for our theory of the unknowable. The answer to this question ought to tell us plainly what existence is in itself and in all its details, and such an answer must include a clear definition of the law of existence.

8. THE LAW OF EXISTENCE.—We are now getting close to the final solution of the great question; but don't let us be to sure, we haven't got it cornered yet.

In the making of our language we often find it necessary to coin a new word as a name for some newly discovered distinction among things. In the construction of the new word we simply change the sound of the voice; thus articulating a different word. The new word must have some difference in it so that we can distinguish it from other words, just as we must distinguish the new thing from other things. This difference of form in words is a necessary truth of all language. To me it is impossible to understand how we can have a plurality of words without making them different, and it is just as impossible to see that there is anything in this difference but a change of form in the voice. It is the same voice used in the pronounciation of thousands of words, and there is really nothing in it but sound and difference, when considered in itself and apart from its meaning. The meaning is the associations which we give it to make it available in our language. Without the sound there would be no difference and hence no words and this would be nothing so far as language is concerned. Without the difference in the sound there might be sound, but words would not exist. Hence it is plain that words are made out of sound and that in the making we simply make difference in the sound. While I am listening for sounds if I hear nothing, I can truthfully say that I hear nothing; or in other words I hear the total absence of sound which we call perfect silence, and I am able to do this solely because of the difference between sound and silence. Perhaps it is not correct to say that we can hear silence; but it is correct to say that we can be aware of a state of silence. So it is evident that I can and do, know both sound and silence, in fact it is impossible to understand how I could know either without knowing both, and it is as plain as the nose on my face that I know both by their difference.

Now for the same reason I am led directly to the idea that things are caused in the same way. Every word is not only a word, but it is a part of that something called sound and in which some difference is necessary in order to produce the word. So every thing is not only a thing, but it is a part of something in which some difference is necessary in order to produce the thing. Now, if this something in which it is necessary to create difference in order to create things, did not exist, there would certainly be no things; and I can think of the absence of this something—which of course would be nothing so far as things are concerned—just as easy as I can think of silence or the absence of sound. So it is evident that I can, and do, know both things and nothing; in fact it is impossible to understand how I could know either without knowing both, and it is very plain that I know both things and nothing in the same way that I know words and silence—by their difference.

For these reasons I am convinced that difference is absolutely necessary to the existence of both things and nothing, and that the difference must be in something which is common to all things, and in which any particular thing, in order to exist, must differ from other things while all together must differ from nothing. This simple word difference, one of the most used and most useful in our language, and which has its equivalent in all other languages, is therefore one of the most necessary factors in the Law of Existence. This law, which will be fully explained as we proceed, may be regarded as The First Principle, because no other principle can preceed it and because it prescribes the very conditions under which existence is possible. But difference is not the only important factor in the law of existence. As is well known the character of a thing is often, if not always, determined by its relations to other things. In the many possible relations of things, beginning with their difference, it seems that we can account for all the most minute peculiarities of things in their most obscure relations. But difference must be regarded as fundamental to all relations. We cannot expect relations without things, and things must depend on difference in something as a fundamental substratum of existence. What this something is, will be considered in the next section.

If difference is the first essential to the existence of things, it must be also a first condition to sense experience and knowledge, and this it certainly is. Mind can know only things and nothing, and each thing in order to be known, must be distinguished from nothing and from other things, through a sense of their difference and relations as prescribed by the law.

This, in brief, is the Law of Existence, or it may be properly called Universal Relativity. Under the name of Relativity or Relations this principle has been recognised by others in different forms. Among those known to me may be mentioned, Hobbs, Hamilton, Mansel, Bain, Spencer, Condillact and at the present time, Lodge, Fisk and Burroughs. It seems that Prof. Bain has given the most complete account of this law in his Logic. But so far as I can learn no one heretofore has applied it as far as it seems to me possible; hence my object here is to push its application much farther, if not to the limits. I would regard it as the law of all laws because I believe it preceeds and includes all things and nothing. Feeling convinced that this is the primary law, that there is nothing deeper and that there is no limit to its application until we reach the limits of the universe, I have accepted it as my chief guide throughout this work. It is the key to all knowledge of present existence. To define anything is to distinguish and describe (1), all its differences from other things and nothing, and (2) all its relations to other things and nothing. When we have done this, we then know what that thing is to the utmost extent of possible knowledge. But it is not assumed here that any one person can encompass the utmost extent of possible knowledge. This is the law which may at least guide us far beyond the present limits. But there is much more to be said in order to establish this law as an unquestionable truth,—to appear in the following sections.

9. WHAT EXISTENCE IS.—Up to this point it seems certain that we are on the safe ground of truth. It is clear to me at least that the whole of existence is at least things and nothing, and that I am one of the things, and that I and the other things can exist only as required by the law of difference and relation or Universal Relativity. But now we have reached the point where it is evident that if we make another step forward we must answer the question, what is that ultimate something, in which it is necessary to make difference in order to make things.

For me it is impossible to think of an ultimate something unless I think of it in the nothing-something relation. This is that simple relation of difference which is in constant use by everybody, even the animals. When the teacher sketches the form of a horse on the black board the usual ideas of a horse are at once aroused in the minds of the scholars. But few, if any, of them ever think of the fact that their perception of the sketch had its origin in a mental act which was simply a sense of the difference between the white lines of chalk and the black surface of the board; and which mental act is properly called a sensation. The difference on the board is out of mind, a part of the not-self and it has nothing to do with the sensation but to serve as its object. The scholars think of the horse more than they do of the board and chalk lines, because the horse is the principal object of their attention; just as we do when reading a book that holds our attention to the subject of the book and so prevents our attention to the white paper and black letters. But the scholars must have some degree of sense perception of every line of chalk on the board and we must perceive every letter in the line of printed words our eyes are following, else there is no perception at all. This is proved by the fact that the same chalk lines on a white board or the black letters on black paper would not be perceived at all, and the reason is, first of all, the difference. It is this difference of effect in the sense organ due to the contrast of black and white, that we first perceive in all such cases, which we can readily prove by close attention to the contrast; but what immediately follows, may be an idea or a string of them wholly unlike the perception of black and white, and which ideas are called up through a previous association in the mind with the thing immediately perceived. It is thus evident that our perceptions in their immediate sensation parts are often overlooked by us because our attention is taken at once by the dominant idea or memory already in the mind and which is revived into consciousness by previous association, with the external thing immediately perceived in the sensation or through it. It is right here that education interferes with common sense; often so far as to ruin its practical value. Common sense looks directly at things as they are perceived directly through sense experience; while education looks directly at the ideas or memories which have been previously associated with sense perceptions as a result of the education.

Now, if we stick to our common sense and ignore our education of high-flying ideas, we are bound to see that the true idea of existence involves an idea of non-existence. and that to think of either is to think of both. If the children at school were asked to explain why they are able to see the picture of the horse on the black board, perhaps some of them might be led to see that the picture is a result of the difference between black and white. This, so far as it goes, would be a correct explanation, but it could not be arrived at without close attention to the sensation end of the perception; and this is what we do when we exercise common sense. But a complete explanation of all that takes place in any ordinary case of sensation would involve a complete theory of sense perception; and as will appear later, this may be obtained in the same way, by the careful use of common sense.

In exactly the same way we must look at this problem of ultimate being. So I will offer the following as a simple induction from a few facts of sense experience, and which seems to lead to a very important general truth. What I offer below was written nearly forty years ago, before I had read any thing on the subject of philosophy and when my common school education did not extend beyond reading and writing. At that time I had nothing to guide me but common sense, and to this day I have never been able to see that I am possessed of any greater share of this valuable inheritence than the average of men. In all my business ventures I have failed and this fact has led me to suspect that my common sense is certainly not above the average and most likely not equal to it.

"Suppose I have before me a vessel filled with water. If I pour the water out, the vessel is then said to be empty; but strictly speaking, it is not entirely empty, since it contains the air and other gases which are always present. Now if I could remove all substance from within the walls of the vessel, it would then be empty in the strictest sense of the word; it would contain nothing. In this way, and with entire conformity to the principle of relativity, we can think of the vessel as containing nothing, or we can think of it as containing something. Here is an important consideration. When we think of the vessel as containing nothing we are obliged to think of it as containing space; or, when we think of it as containing something, the same space is present, and not by any mental effort can it be reasoned away. I feel convinced that no rational mind will ever question the validity of this way of thinking. Call it old, commonplace, vulgar or what you will, it is none the less legitimate."

"Space is everywhere and always present, both within and without the walls of the vessel, whether it contains something or nothing. What is space? We can by legitimate thought remove everything from within the vessel, but we cannot remove space; hence space is not something, and if not something, it must be nothing. Since we are permitted to think of but one kind of nothing, it appears conclusive that space and nothing are identical, and that this is the same nothing which our scheme of relative thought requires. From this conception of space it follows that when we attempt to think of anything which is not space or nothing, we must think of something;

and when we attempt to think of something in any possible sense, we must regard it either as a substance which occupies space, or as some property, form, state, kind, quantity, number, condition, mode of existence or activity of this substance. Any idea of anything is inseparable from the idea of a substance which occupies space, for the conspicuous reason that such an idea cannot be otherwise distinguished from the conception of space which this law requires; and is therefore unthinkable. This space occupant has received the general name matter."

The above has been copied word for word from the old manuscript written some time between 1870 and 1875 (date not preserved.) It answers my purpose here as well as anything I could say at present. From the Idealistic point of view it is not philosophy, but I am convinced that it is the ordinary common sense which we find more or less in every body. Further on in the same original manuscript I have a definition of space in these words:—

"Without matter or mind, space would be nothing in the most absolute sense. In the presence of mind and of the changing forms of matter, it is an object of consciousness."

The above is the first form of my definition of space and it was published in 1895 and had a circulation of about seventy-five copies. This definition will show plainly that I have never committed myself to the absurdity of assuming that space is both nothing and something at the same time. As will appear later, time and space may both be regarded in two different ways, both of which ways are in harmony with the law of existence, and both are correct as defined above.

So far it seems that we are in actual sight of that ultimate something in which it is necessary to create difference in order to create things. Matter must be divided into parts and diffused in space in such forms, and with such movements as will enable us to account for all the differences, similarities, transformations and uniformities which we constantly perceive in the surrounding physical world. All matter formed as a single homogeneous mass of vast extent and having no parts or space unoccupied within its limits, would present to the mind but one thing; the difference of space-matter, and in the presence of but one thing, consciousness would be out of the question. Hence it is that the very existence of things and thought must depend on the division and diffusion of matter in space. While this looks like placing a limit to all further knowledge it is at most only a limit to the proper sphere of knowledge. It would be nothing but rebellion against common sense to assume that space can be limited, or that anything can exist and not be either a space occupant or something that belongs to a space occupant; and any possible space occupant may be properly called matter. The universe of things, if it is something, must be first of all a material universe, and for the same reason that space is unlimited this material universe must be limited in space. This is the Finite; and within its limited sphere we may look for Mind, Spirit, Life, here and hereafter, and all things known or unknown. Here we can hope to find God and all His works and all the proofs of His great wisdom. And this is not a closed system, which forbids the further advance of our knowledge. We have no business with that infinite god who is created by the mistakes of men, and who is supposed to stay around somewhere outside of the universe and in that limitless infinite of misguided imagination.

I am not troubled with any fear that the common people will fail to understand or accept this conception of the ultimate. But the philosopher will no doubt cast it aside, and he will find many reasons for so doing. It is the old view of the Greeks before the time of Plato; besides it is too simple to be true. We cannot account for all things as a mere result of difference in one universal substance. There is something more in things than what we distinguish by sense of difference. For these reasons I must offer more convincing support for this conclusion. A generalizing principle must prove its efficiency in its general application, and this is attempted in the following chapters after we have reached a complete definition of the principle.

10. CONDITIONS OF EXISTENCE.—This is only another name for the law of existence, which I have called the key to all knowledge. We ought to decide once for all, upon a full and clear definition of it, hence a little farther consideration seems necessary. Evidently its first and most necessary application must be to the as yet undefined relations of time, space, matter, motion, mind.

As shown in (§ 8), this law of difference, relations, or universal relativity, distinctly affirms that things are things only by reason of their differences and relations, and that nothing, though not a thing in itself, is, and must be, an object of thought. As a test for the truth of the principle, let us carefully proceed on it in its application to the ultimate truth. From this law, as here defined it follows that time and space are something, because they differ from matter or from that ultimate something which in order to exist must occupy time and space. It also follows from the same law—but in a different sense—that time and space are nothing, because of this peculiar relation to matter. So it may be objected to that the law contradicts itself, and hence it is not a law of Nature, because it makes a thing both something and nothing at the same time. In the differences of time, space and matter, time and space are something; in the relations of time, space and matter, time and space are nothing. The definition must include both differences and relations in order to make it cover all objects of thought to which we have given names and places in our language; hence the seeming contradiction. But it is only a false appearance. In another sense—and a strictly proper and necessary sense—a thing may be both something and nothing at the same time; dependent on the relations in which we view the thing. The human mind would never have any idea of nothing, and hence no such word, if there was no object in human experience necessary to give rise to the idea. The object necessary to give rise to the idea is always a result of the relations of things. When I look at an empty basket, I get the idea that there is nothing in it, yet farther examination will convince me that the basket always contains the air and other gases. But farther consideration will convince me that if I could remove all substance from within the basket, then it would certainly contain nothing and so my idea of nothing is a direct result of experience and legitimate inference from such experience. The object necessary to give rise to the idea of nothing must in itself be nothing in one or the other of two senses: (1), as not being something sensible or expected, and (2), as being out of all relation to other things. In the first sense nothing is an object, because it is the absence of some particular thing in the place of which there may be other things; in the second sense nothing is an object, because it is the absence of all things—a complete void. But in either sense; in order to be known as nothing, it must be known in its necessary relation to something, then it becomes an object of thought and to this extent, and only to this extent it is something. In other words, the human mind would never be able to know nothing if it were not something in this particular sense. But it is something only in its relation to that something which it is not, and this is so for the simple reason that knowledge implies things or objects known, and they are known only by their differences and relations.

Human thought is therefore in perfect harmony with our definition of the law of existence. Nothing is something, because it differs from existing things when viewed in relation to them, and at the same time it is nothing when viewed in itself and out of all relation to existing things. But it is not something in the same sense that we regard existing things. Nothing in itself can be thought of as an universal possibility, but not as actual.

Now, it must be evident that time and space are the only objects in human thought which can be made to fit with perfect harmony, or even to enter at all, into this definition of the law of existence. They are something, because they differ from the things which occupy time and space, and they are nothing when considered in themselves and out of relation to such things, and also because they are not something in the same sense that we regard the things which occupy time and space.

But if time and space are nothing in themselves, then how have we come to distinguish them and give them different names, since it is not lawful to have two kinds of nothing. To settle this question from common sense let us consider them separately. The common idea of time belongs exclusively to mind, but in some minds it is clearer and less adulterated with fallacy. We have got this idea during long ages of experience in an external world of realities and it must represent one of the external realities. Like all true ideas, the idea of time must represent a real tangable object, for if it did not we would never be able to account for it. In all human thought there is nothing more simple or better known than these common ideas of time and space. We understand (1) that this idea of time in itself is real; we know (2) that this real idea of time is not time itself. Any one who knows the use of a watch can see that his idea of time may not correspond with a correct measure of time. Time is said to be either absolute or relative. It is absolute, eternal or all time, when consideaed in itself and without relation to the things which exist in time. If there were no things there would be no time, either absolute or relative, hence even absolute time is a relative object because it is nothing but the absolute duration of things, and without which there would be no time. Relative time is supposed to be time in its relations to that which exists. This is the true idea of time. The divisions in time are all in relative time because they are inseparably concerned with the things which exist in time as in the relations of past, present and future. That which has duration in itself yet which is continually changing its forms, takes time, or rather the time is the enduring quality of the thing itself.

Almost the same definition may be applied to space that we have applied to time. Absolute space like absolute time, is space in itself. It has no differences, no relation of parts, no parts and no things, and hence, nothing which can be related to space or even to time. So far time and space are the same object, for there is no difference between them on which to base a distinction, and this agrees with the idea that both are nothing when considered apart from that which exists in time and space. It is only when we come to compare relative time and relative space that we are able to distinguish the two.

Relative space like relative time, is always and necessarily related to things which exist in time and space; but they differ in the fact that while time provides all the relations of succession or duration of the things which exist or occur in time, space provides all the relations of co-existence and position among things in space. In time we have the relations of change, succession, duration past, present and future; in space, the relations of position, forms, co-existence, dimensions, distance, etc. It seems clear that these are the principle, if not the only reasons by which the two have been distinguished and so have come to be known as necessary parts of our thinking equipment, and all of these exist only as related to that which occupies time and space.

11. WHAT THE PHILOSOPHERS SAY OF TIME AND SPACE.—During the present year (1908), I have read nearly everything I could find in the Denver Public Library on this subject of the ultimate, or of the relations of space and matter, for the purpose of making sure that my definition of the law of existence described in preceeding sections, is original; also to learn if this general theory is new to any extent, and if so, how much so. So far as I have been able to go into the literature of the subject, this theory of the universe is not only fundamentally new, but to a very great extent new in details. All the writers now known to me, who have offered an opinion or a definition, on the ultimate nature of being, or the relationship of time, space, matter, motion, mind, agree with me only in one respect. To show how perfectly we all agree in this one particular, I have quoted the exact words of twenty different writers who are among the best known and most authoritative of the philosophers and scientists of all ages. Just how far we agree will appear at the end of this section. It will also appear at least possible that the difference between myself and the others, is simply due to the fact that the others have failed to work out the true solution of the problem; and so have been compelled to give it up; or recognize nothing in it but a profound mystery. As to whether I am right or not, will depend on the common judgment in which I have perfect faith.

In Baldwin's Dictionary of Philosophy and Psychology, space is defined as:—"The abstraction of the mutual externality of objects actually perceived or thought as co-existing in possible experience, and represented as a continuous homogenous magnitude of three dimensions, infinitely divisible and limitless in extent. The philosophy of space treats of the logical and real nature of that which is so represented."

Notice here that space is something more than what I have made it, in fact, it might be regarded as a substantial entity, as much so even as matter, because it has three dimensions and is infinitely divisible and limitless in extent, yet it does not occupy space. This Dictionary is now regarded as a high modern authority.

From the same authority, also from Dr. Erdman's history of philosophy, I have obtained the following from the philosophy of the Ancient Greeks, but I have not quoted the exact words of these writers.

Plato (429 B. C.) was the first to attempt a definition of space for the benefit of posterity, but with him it was only an idea. Like Socrates, he thought that our sense perceptions of the material world are unreliable. Our senses were not given us to instruct, but only to pursuade. The mind is nourished by ideas which come to it direct, not through sense experience.

Aristotal (385 B. C.) in his sixth book takes up the subject of Ontology—the question of what existence is. With him the first question is, what do we mean by first principles? His answer is worthy of notice here. He finds it in the usage of language as given in the past history of thought. The physiologers (philosophers previous to his time) attempted to explain being as a material substance. but they did not agree on the relations of space and substance. It seems that there was general agreement between ideas and sense experience, (and it is the same to this day), but they could not agree as to the true relations of their ideas, or rather of the things represented by their ideas; and this is also true of the modern philosophers. To the time of Aristotle the question of dispute was, the existence or non-existence of empty space. The atomists, among whom were Lucippus, Empedocles, Anaxagous and Democritus, believed that empty space was necessary to account for the motion of matter. The followers of Phythagoras contended that space is a real substance, a kind of thin air which is unlimited in extent, and surrounds this world and which is inhaled by it. Aristotle himself was very clear in his conjectures about space. He believed it to be distinct from matter, as proved by the fact that different bodies successively occupy the same space. It also has its independent character, he thought, as shown in the fixed relations of up and down or right and left. But this is only true of relative space, He asks: "What is space; what is its genius? It cannot be a body, for then two bodies would be in the same space. Neither can it be a pure object of thought; for such objects have no magnitude. Nor is it any of the four causes; it is neither the matter of which anything is composed, nor its determinating form, nor its efficient cause, nor its end. Again, if it exists, what is it? as Zeno so effectually asked." The problem was thus regarded as a very difficult one, but it was generally agreed "that space was something objectively real and not merely relative to thought."

In the middle age the philosophers were occupied mostly with questions of religion and the subjects of time, space or matter were neglected. Hence, there was little or no progress beyond the then prevailing theological wisdom. In fact, in many quarters it was considered a sin to speculate on questions of philosophy, and no philosopher was welcomed who did not support some so-called revelation of theology.

Modern philosophy begins with Rena Descartes (1592). He was a mathematician who believed that a combination of logic and mathematics would prove helpful to all branches of knowledge. But unfortunately he did not accept sense experience as a trustworthy source of knowledge. Mathematics is undoubtedly a branch of the universal law of relations.

Nicholas Malebranch (1638) another French philosopher, held similar views to those of Descartes. The senses have been given to us to preserve life, but they do not give us full information as to the inner nature of things.

Baruch De Spinoza (1632) believed firmly in the reality of matter. Only one substance exists, he said, and all things, including God, are to be found in it. But the publication of his books was forbidden by church and state, and he was denounced and excommunicated by his church with the following anathema: "With the judgment of the angels and of the saints we excommunicate, and obscure, and anathematize Baruch de Espinoza, with the consent of the elders and of all this holy congregation, in the presence of the holy books, by the 613 precepts which are written therein, with the anethema wherewith Joshua cursed Jerico, with the curse which Elisha laid upon the children, and with all the curses which are written in the law." In addition to this awful curse, not half of which is quoted here; his life was secretly attempted and he was obliged to flee from Amsterdam, his native city. All accounts agree that he led the life of a "righteous man, who gave up all else that he might seek the truth for its own sake." The authority of Plato, Socrates and Aristotle, had little weight with him, but he was a close follower of Democritus and the Greek Atomists, also Lucretius.

The skeptics of this period held that the senses and reason are uncertain sources of knowledge and that we must depend on faith in divine revelations. The mystics at this time held similar views. They reproached the mind for its ignorance of the world and helplessness, and so encouraged supernaturalism.

John Locke(1632). To discover how the mind gets its ideas, should be the first step towards ultimate knowledge, says Lock; and this seems to me exactly right. Our perception of external objects, according to him, are properly called sensations. Our perceptions of memories (recollections) are called reflections, and both are passive. Out of these the active mind forms its ideas. If in these ideas there is agreement, then we understand; if not, then we don't understand, and understanding is knowledge. This seems a very good account of the right mental process to start with and perhaps if it had been pushed further it might have reached the goal of knowledge.

Leibnitz (1647) believed in ultimate atoms or nomads possessing self-active powers, and a correct knowledge of which is the key to philosopby. Speculation took two principle branches soon after this period, which have held their own to the present day; that of Materialism and that of Idealism. Materialism was advocated by Diderot, and others in France, Germany and England, and according to which nothing exists but matter and motion, which latter is inseparable from matter and not communicated to it from without. The sum of existence is Nature, and in nature there is neither purpose nor order, but simple necessity.

George Berkeley (1712) was an Idealist of great distinction in his day, and is so even to the present day. According to his philosophy: "Matter—the material thing which we call substance—is a phenomenon; instead of being, as was previously supposed, something entirely unphenomenal and inaccessable to the senses." In another place: "It is not something invisible, intangible, inferred from what we see and feel, but it is itself the very thing which we see and feel. A phenomenon or an idea can be round and big, and as hard and as heavy as a millstone. The mind is not within the head or brain, but on the contrary the head, being a sensable object, is within the mind, with all the sensable objects and spaces and vast distances that constitute its contents. For this reason, to be within the mind and to be within the sensable universe [or the universe of ideas] means the same thing; as also to be outside or external to the mind, and to be outside or external to the sensable universe means here the same thing. The sensable universe, though within the mind, is not within the small portion of itself which is called the head, but outside and around the head at all its vast distances. Mind or spirit, is exempt from space as well as from any other sensable quality, and this being so, it cannot occupy space nor exist in it; that on the contrary, all space and its contents exist in spirit, and cannot but so exist."

The above account of Berkeley's philosophy is from an English book by Collyns Simon, L. L. D. In his summary he says of it: "We so far have Berkeley's own grand proposition and doctrine, that matter is a mental thing and the material universe a mental universe—that the physical substance of Nature is essentially a phenomenon. There is no substance but Spirit."

I have quoted considerable from this author in order to make it certain that I do not misrepresent him. Without attempting to criticise this theory in detail, I will only remark that in one respect it is in perfect harmony with common sense, while in another respect it is about the best example of a bad use of common sense I ever met with. It is certainly true that we do perceive things directly and immediately by our senses; in particular, the primary qualities of matter. In my theory of sense perception (book 2), I will try to demonstrate the fact that the human mind is always in direct contact with that thing which we call matter. But it is certainly not true that mind and matter are the same thing. The distinction of mind and matter is just as clear to common sense as the distinction of motion and matter. When we look at a swinging pendulum, we do not have to think very hard in order to know that the swing of the pendulum (motion) and the substance of the pendulum (matter) are two things; to which we have given the two names motion and matter. We can prove this by taking all the relative motion out of the pendulum without reducing its weight one grain. When we look at a body of living matter we do not have to think very hard in order to know that the life or mind of the body (which is plainly shown by the sensability of the body as appears in certain well known movements) and the substance of the body (matter) are two things; to which we have given the two names mind and matter. We can prove this by taking all the sensability out of the body without reducing its weight one grain. We distinguish between mind and matter in exactly the same way that we do between motion and matter; by their difference. The law under which all things must exist is very clear on this point, and Berkeley has evidently overlooked one of the most important distinctions in philosophy. This doctrine has given a strong impetus to modern Idealism; and it has also served as the initiative of a good deal of modern Skepticism.

David Hume (1711). Prof. Huxley in his Life of Hume, says: "The final result of Hume's reasoning comes to this—As we use the name of body for the sum of the phenomena which makes up our corporeal existence, so we employ the name of soul for the sum of the phenomena which constitutes our mental existence; and we have no more reason in the latter case than in the former, to suppose that there is anything beyond the phenomena which answers to the name. In the case of the soul, as in that of the body, the idea of substance is a mere fiction of the imagination. This conclusion is nothing but a rigorous application of Berkeley's reasoning concerning matter to mind, and it is fully adopted by Kant."

All such reasoning looks like a cheap and dubious makeshift for a deficiency of understanding. All these men, and none more so than Huxley himself, (who held to similar views) had all our common sense ideas, which every man must have in order to live, but it seems that none of them possessed the constructive ability which would enable them to systematize their ideas in the way that might reveal the absolute certainty of the external reality of matter. When this is done by the simple method of analysis and synthesis, (§3) by which we separate our representative ideas from the external things represented, and by which we are able to put the represented things into a consistent and necessary system, then we have in unmistakable plainness something beyond our phenomenal ideas which may answer to the names, matter or substance.

Dr. Thomas Reid (1710). Here is something on the space matter relation which we ought to remember; for it is more like a return to the common sense of the Greeks before Plato, than anything that has appeared in the interval of 2000 years. "There are determinations concerning matter which I think are not solely founded upon the testimony of sense: Such as, that it is impossible that two bodies should occupy the same place at the same time; or that the same body should be in different places at the same time; or that a body can be moved from one place to another without passing through the intermediate place. These appear to be necessary truths and therefore cannot be conclusions of our senses; for our senses testify only to what is, not to what necessarily must be." These are undoubtedly necessary truths; necessary in the very conditions under which the existence of things is possible. To be readily apprehensive of necessary truths is the true function of common sense. In the above passage Dr. Reid speaks of our innate ideas of the primary forms of matter and their relations, which are necessary to the existence of both things and thought, as tho they were not acquired thru sense experience. In my view the yare already in the mind of the man of average intelligence, but they have been acquired in the past experience of the race. Regarding space he says: "It may be observed, that although space be not perceived by any of our senses when all matter is removed, yet when we perceive any of the primary qualities of matter, space presents itself as a necessary concomitant. For there can neither be extension, nor motion, nor figure, nor division, nor cohesion of parts without space." Which means that matter is in space otherwise empty, and must be divided into parts differing in form and size, and having motion and difference in motion, in order to play its part in supplying the mind with all its great variety of ideas. If we can explain all things and account for all ideas, even the false ones, on the theory of one matter, one motion, one mind, in which there is only difference of state, form and kind, then surely we cannot dispense with matter; and this is attempted in the following chapters.

Immanuel Kant (1724). In his "Critique of Pure Reason." Kant answers the first question of philosophy as follows; which I convey as nearly in the words of the writer (Dr. Erdman) as I can without quoting him. Through the physical sense we have immediate perceptions of external things. These things, (or the sensations, or both together, it is not clear which), are called empirical, because they are given to us and not determined by us. But in the mind they are combined into ideas by the mind itself, and this process of idea making is called a priori judgment, purely mental and therefore not empirical. The mind unites its empiric experiences in two ways: (1), in time, in which we have all our ideas of the duration of things, succession of events, past, present and future, etc.; and (2), in space, which gives us our ideas of coexistence, changes, relations, etc. of things, or what we call the primary qualities of matter. Now, this philosopher seriously declares that time and space are wholly within the mind and a necessary part of its thinking faculty; and hence do not exist outside of the mind associated with external objects as they appear to be. Here I will quote the words of the writer to make sure of his meaning. "That time and space are not something emipirical and given to us from without, but that they are a priori, is proved beforehand by their necessity, since we are not able to think them away, to abstract them, from the mind, which can be done with everything that is empirical. And further, they do not presuppose any individuals (times, spaces), but on the contrary, in order to think time and space, we must have beforehand time and space. That finally they lie only in us, are something wholly subjective, is shown by the fact that mere space distinctions, as that between a hand and its reflection in a mirror, cannot be fixed by objective description, but only by recourse to the distinction, left and right, etc., to relations which refer immediately to perceptions."

Here again we have a learned philosopher, in full possession of his wits and all the common sense ideas about things, not only those of time and space but all the primary qualities of matter which must exist in time and space if they exist at all; yet he deliberately proceeds to separate our ideas of things from our ideas of time and space, and to graft upon our ideas of time and space his own newly invented idea that time and space are not external realities associated with the material things as they always appear to be, but are exclusively contained in the mind, and nothing in themselves but necessary elements of the mind's idea making faculty; while the things which we must have to think about are outside of us somewhere, yet they do not exist in time and space. No wonder that so many of the common people have stumbled over this philosophy-born conception. It is of course true that we combine our sensations and memories in two ways; in time, which gives us all our ideas of duration, succession, etc., which are memories, with sensations which present things external, and in space which gives us our ideas of coexistence, distance, magnitudes, etc., also memories, with sense perceptions of external things. There is no chance to dispute the fact that we have very clear ideas about time and space, and that they are a priori or inborn, having been inherited from past generations and originally acquired through sense experience in a physical world, and that we use them along with all our sense perceptions of external things. And it is equally impossible to dispute the fact that time and space are outside of us, intimately associated with the material things which we perceive. Within the mind time and space are represented by our ideas of them, which of course are indispensable to thought. But outside the mind we have the real external objects, time and space; and without which objects, related as they are to all other objects or material things, it would be impossible for the mind to have ideas of time and space; nor would it have any ideas at all. Kant's mistake appears in his acceptance of his ideas of time and space as the whole thing, without inquiring how he got the ideas. Whether he accounted for them in any other way is not known to me. It is true that we can think away any or all objects in time and space, but we cannot think away time and space. This follows from the simple fact that in order to think at all, we must have things, and the things must have difference and relations. The first possible or thinkable difference, and the first possible or thinkable relation, is that of nothing-something and the only thinkable reality which answers to this nothing-something relation is time and space on the one side and matter on the other. Now, of course we can think of the absence of matter, because it is something, but how can we think of the absence of nothing? The only way that I can attempt to do it is to quit thinking; but the moment I begin to think again I know at once that I did not succeed because I cannot even begin to think without thinking of something as existing independent of me and in time and space.

Dugald Stewart (1753), was a disciple of Thomas Reid, and he agreed with Reid in, that philosophy should begin with principles on which the certainty of truth rests and by which it can be known. Reid had recognized this first principle under the name of common sense. Stewart objected to this name and called it the "Fundamental law of human belief." Regarding space he says: "The idea of space is manifestly accompanied by an irresistable conviction that space is necessarily existent and that its annihilation is impossible. To call this proposition in question is to open a door to universal skepticism."

Thomas Brown (1778). A pupil of Stewart, says of space: "The truth of space and of the world, being in our reasoning skepticism the same, we cannot deny space and admit the reality of sensable objects.

Sir William Hamilton (1788). the most learned of the Scotch philosophers. He was the editor of Reid's works and held too much the same views of Reid and Stewart. With them he upheld the doctrine of Presentationism, according to which we have an immediate and intuitive knowledge of things themselves, and which doctrine has since become the leading tenet of Realism. This is only another name for common sense. On the subject of space Sir William says: We have a two-fold cognition of space; (1) an apriori or native imagination of it in general, as a necessary condition of the possibility of thought; and (2) under that an aposterior or adventitious perception of it, in particularly as contingently apprehended in this or that complexus of sensations."

In the above passage we have the plain admission that space is "a necessary condition of the possibility of thought," and this is what it is beyond the chance of a doubt. We can say the same of time. It is worthy of mention here that Hamilton was a believer in the doctrine of Relativity and that he used it successfully in bringing out a conclusion which I believe to be of the greatest importance. But unfortunately he failed to apply this law so far as he might have done, and he made one very bad application of it. In his philosophy of the unconditioned he reaches substantially the following conclusion, and here are his words: "The mind can conceive and consequently can know, only the limited and the conditionally limited." The unconditionally unlimited, or the Infinite, the unconditionally limited or the Absolute cannot positively be constructed to the mind; they can be conceived only by a thinking away from, or abstraction of, those very conditions under which thought itself is realized. * * * The consequence of this doctrine is that philosophy if viewed as more than a science of the conditioned, is impossible. Departing from the particular, we admit, that we can never in our highest generalization, rise above the finite; that our knowledge, whether of mind or matter, can be nothing more than a knowledge of the relative manifestations of an existence, which in itself it is our highest wisdom to recogize as beyond the reach of philosophy.

Now, take notice: The first fifteen words in the above quoted passage are intended as a definition of the limits of our knowledge. If my understanding of the question is right, they are true only in this sense. Whatever exists, must exist under conditions which are limited and necessary to that which exists. As shown in (§ 8, and later), the mind can know only things and nothing, and the only things that can be known are those which occupy time and space, and the only nothing that can be known is time and space without anything in them. This is clearly a limitation of existence, and if this is true, then of course, the mind can know only that which exists under the limited and necessary conditions of existence. Hence, it is true that philosophy, if viewed as more than a science of the conditioned, is impossible. But it is evident that Hamilton did not see the question in this light. He thought there was something beyond these limits which we can never know, and his ennunciation of this belief misled many others, prominent among them Spencer.

Sir John Herschel (1792). "The reason we conceive, why we apprehend things without us, is, that they are without us. We take it for granted that they exist in space, because they do so exist, and because such their existence is a matter of direct perception which can never be explained in words, nor contravened in imagination, because, in short, space is a reality. That which has parts, properties and susceptibility of exact measurement must be a thing."

The reality of space is here plainly recognized, but it is not correct to say that space has parts in itself, or properties, and is susceptible of measurement.

J. S. Mill (1806). "The character of space, all that belongs to it as space, is its three dimensions with all their geometrical properties, also its character of Infinity."

Alexander Bain (1818). Extension belongs both to solid matter and to the intervals between the masses of solid matter, which intervals are measured by the same sensabilities, namely, the muscular feeling of motion, supported by the passive sensations."

Herschel, Mill and Bain, all have fallen into the same error, in fact, this has been the prevailing view to the present day. At the end of these quotations I will comment on this.

James McCosh (1868). "In particular, space has three dimensions—length, breadth and depth—that, is, we can contemplate it as extending along any given line, as spreading out in a surface, or as going out in all directions.

Dr. McCosh was the ablest of the modern exponents of Realism, and here is his definition of it:

"Realism is that system which holds, that there are real things and that man can know them; that we have no need to resort to such theories as those of internal ideas or occasional causes coming between the perceiving mind and the perceived object; but that the mind knows directly and intuitively three kinds of reality—first, matter, whether existing in the body or out of the body, as external, extended and resisting; second, the perceiving self as thinking or willing, a reality as certain and as definite as matter, but perceived by self-consciousness and not the external sense; third, the objects perceived by our conscious or moral sense, the higher knowledge of voluntary acts as being morally good or evil. The mind perceives matter at once, but it also perceives benevolence, and perceives it to be good as clearly as the eye perceives objects to be external."

Herbert Spencer (1820). "What now are the attributes of space? The only one which it is possible for a moment to think of as belonging to it, is that of extension; and to credit it with this implies a confusion of thought. For extension and space are convertable terms; by extension as we ascribe it to surrounding objects, we mean occupancy of space; and thus to say that space is extended, is to say that space occupies space. It results therefore, that space and time are wholly incomprehensible. The immediate knowledge which we seem to have of them, proves, when examined to be total ignorance. While our believe in their objective reality is unsurmountable, we are unable to give any rational account of it."

Not only time and space are thus banished to the limbo of Unknowableness, but matter, motion, mind, force and everything else in its ultimate nature are disposed of in the same way.

Messrs. James and Schiller's views on space and matter have been given in (§ 2).

12. COMMENTS AND CONCLUSIONS. All the writers quoted in the preceeding section seem to agree in one respect at least, and that is, the objective reality of space. Admitting space, they would all no doubt admit the reality of time, and though several of them have denied the reality of matter, they have all admitted something which we call matter. They have also without a single exception admitted the reality of some thing which we call mind, and even motion has not been ruled out in any case. And I am obliged to frankly admit myself, that I agree with all of them in this respect. We have all got the same ideas, and this is true the same of all men, at all times and in all parts of the world. Now, there must be a common reason for this universal peculiarity of mind, and I firmly believe that we can find it in a rational Materialism. All our

simple and common ideas of time, space, matter, motion, mind, are a pure result of the physical conditions under which we are born and must live, and they are forced upon every man by his inborn common sense and as a matter of necessity, whether he likes it or not. These philosophers were obliged to admit their ideas, but they could not understand them, and they have got them so misplaced and badly mixed that no one else can understand them.

We have got the ideas sure and it is only necessary to put them together right to make them represent a system so perfect, so complete and necessary to our life; and so convincingly evident of Supreme wisdom, as to astonish even a philosopher. If our definition of the condition of existence (§ 10) is correct, it will not be difficult to see that space and matter are related, not only as objects, but in all the other great multitude of relations in which the nothing something relation is necessary to the existence of things. In the sense, that matter is only an object space is also an object and both are real; but in the sense that matter is something substantial and necessarily a space occupant, space is nothing of the kind. A man may know the difference between a horse and a cow and not know anything else about either. Space and matter are both objects when viewed only in the objective sense or relation, but when viewed in other relations, matter at once becomes something more than an object.

Philosophers have credited many things to space which belong only to matter. Space in itself has no dimensions, but the material things which occupy space all have. The properties of geometry and all truths of mathematics are abstract laws of existence which may apply to existing things, but they are not existing things. That twice two things is four things may be true, whether things exist or not. If infinite space was entirely empty it would still be true that something could not exist without occupying space, and two things which were equal to a third, would have to be equal to each other, and so with all axioms. Extension, mass, form, volume, impenetrability, softness, hardness, rough, smooth, brittle, plastic, susceptibility to motion, heat, cold, sound, silence, light, darkness, tastes, smells, pains, pleasures and all mental effects, are properties of matter, which are totally absent in space and time. All the harmonies and discords in sound, all the beauties in form and colors, may be found in matter along with all the refined sentiments and tastes, even heaven and hell must be things of matter, because mind itself is a property of matter. These are all truths, not of space itself, but of matter exclusively; and they are known only in the peculiar relations of matter to space already described (§ 10) as the necessary conditions of the existence of things and thought.

It is true that the distance or intervals between two or more material bodies in space, may be more or less, and may be accurately measured; but distance, interval or extension is not space no more than matter is space. Any possible interval, as distance must be defined by at least two points in space, and any point in space must be something that occupies space. No matter how small, it must be something, and being something it is not space, but a space occupant. Now, the extension or diameter or distance between two opposite sides of a mass of matter, as the earth, belongs to the body of matter, not to the space it occupies. For the same reason the extension or distance between two bodies of matter in space belongs to the bodies, not to the space between them. Extension or dimension is therefore a space occupant just as matter is, in fact, it belongs exclusively to matter. To prove this we have only to remove the space occupant and to observe that the extension goes with it.

It seems that Hamilton was one of the most misleading of the leaders of thought in his time. None of those who come after him directly on this line, have done anything but reiterate his conclusions. In his principles of logic he describes the law of thought which he seems to think is a justification of his conclusion, in the following passage:

"All that we can positively think * * * lies between two opposite poles of thought, which, as exclusive of each other, cannot, on the principles of Identity and Contradiction, both be true, but of which, on the principle of Excluded Middle, one or the other must. Let us take for example, any of the general objects of our knowledge. Let us take body, or rather since body as extended is included under extension, let us take extension itself or space. Now, extension alone will exhibit to us two pairs of contradictory inconceivables; that is, in all, four incomprehensibles; but of which, though all are unthinkable, we are compelled by the law of Excluded Middle, to admit some two as true and necessary."

Which, of course, means that space and matter in themselves are unknowable, though it is admitted that one or the other of these extremes of thought must reveal the truth. This author applies the same rule of thought to time. He says: "We can neither conceive an absolute commencement, nor an infinite regress; an absolute termination, nor a duration infinitely prolonged; though either the one or the other must be true."

It seems that Sir William has got the law all right, and his objective ideas of time, space and matter are all right; and his ideas of extension could not be expressed in plainer language;

but when we compare his ideas to the external reality, we see at once that he simply got them misplaced; hence the confusion. It is certainly true that any proposition regarding any object of thought must be either true or false, in whole or in part, and it is true that time, space and matter are real objects of thought; but it is not true that extension or duration are properties of space and time in themselves, neither is it true that time, space and matter in themselves are inconceivable from our relative point of view; on the contrary, it is perfectly clear that extension belongs to matter and that the duration of matter is not time in itself. The reason that we cannot think of a beginning nor of an ending of time, is simply due to the fact that there never was a beginning and there never can be an ending; and the reason of this fact is simply the fact that time in itself is nothing. How can we think of nothing as having a beginning or an ending? The only things that begin or end are the different forms and relations and states of matter, motion and mind.

Now, it seems, that others have accepted the reasoning of Hamilton, and have fallen into the same confusion of ideas. Dr. McCosh asks: "Are space and time made up of parts?" To this I reply, first, and decidedly, that we cannot conceive them as made up of partitions or separated parts, as an apple or an orange is, or as the earth is. But then, secondly, we can conceive proportions in space and time; and if we take any of these proportional sections and divide it into two, thought will compel us to say that the two must make up the whole. If the question be extended beyond this, and asked, is infinite space made up of parts? I answer, that as we can have no adequate motion of infinite space, so we cannot be expected to answer all the questions which may be put regarding it."

This is a clear case of right thinking misapplied. All of the above reasoning would apply to matter, except the ending. but when applied to space or time, it does not fit, hence, the breakdown.

Mr. Spencer asks: Is there an absolute space which relative space in some sort represents? Is space in itself a form or a condition of absolute existence, producing in our minds a corresponding form or condition of relative existence? These are unanswerable questions. Our conception of space is produced by some mode of the Unknowable; and the complete unchangeableness of our conception of it, simply implies a complete uniformity in the effects wrought by this mode of the Unknowable upon us."

This looks suspiciously like a perversion of common sense merely to justify a foregone theory of the unknowable. He asks the very question, the correct answer to which might have led to the true solution of this problem. Notice the two questions at the beginning of the above quoted passage. He simply says: "These are unanswerable questions." It is true all the same, there is an absolute space which bears a conspicuous relation to relative space. Absolute space, or space in itself is absolutely nothing; relative space, or space in its true relations to matter, is an object of thought. Absolute space is known only as possible, not as actual. Volumes might be filled with such questionings and confusion of ideas, and all of which, it seems has come about by overlooking the simple truth that space is nothing as viewed in itself, and something only as a space relation to the forms of matter. Being nothing in itself, we cannot think of it as being limited in any direction, and being unlimited or absolutely without boundary lines beyond which there is no space, it seems, of all objects, to be the best calculated to satisfy the mind which aspires to an all-absorbing infinite.

Space is an object, because it stands alone as the one great contrast to all existing things, and it can be known or thought of only as an unlimited nothing, and only in this sense and in this one instance, space with time may be regarded as something. Time is an object, because it stands alone, as the one great conception of the duration or continued existence of material things. It is sometimes supposed that we measure the uniformities of matter by time, as if it was something in the abstract. To consider time in itself as a fixed standard of the measurement of duration, is a mistake. We cannot measure time in itself by time in itself, no more than we can measure a stick of cordwood by empty space. Time is only a name which we have given to the uniform succession of changes going on among material things. Here on earth we measure these changes not by time as an absolute rule, but by the uniform motion of the earth on its axis, which in itself is uniform as a direct result of the law of inertia or conservation of motion. Just as there is no extension, resistence or dimensions, without space occupying things, so there is no time without space occupying things which have uniform motion.

It is, of course, possible to think of any form or figure, or any extended thing, in the abstract, that is, as separated from any space occupant of similar form, and some idea of space is necessary in which the objects of our thought are supposed to exist; but in such thought we are not thinking of space, but the things in space. To confound such objects with space, would be to fail to distinguish the real differences between space and the things which must occupy space, if they exist at all. The only things that properly belong to space and time are the names, unlimited, unconditioned, infinite, nothing, and the meaning of these words is well known.

It is also possible to think of the things which occupy time and space as undergoing changes due to motion, and which changes are more or less uniform. Mind is able to distinguish between the uniform and the ununiform or irregular, by their difference and by the fact that these changes succeeded each other. From which comes our ideas of time, and so it is that if these space-occupying things did not exist, there would be no such thing as time from our point of view. To prove this, let any person attempt to estimate time in the abstract, that is, to guess the length of one minute or one hour, and see the impossibility of it. Time is measured only by a fixed unit which is a real something, and something always belongs to matter.

Thus, in the relative manifestation of a knowable existtent in its necessary relations to time and space, and which is no other than matter, motion mind, we must look for all things of which to construct our theory of the Universe.

CHAPTER THIRD.

GENERAL LAWS, MATERIAL AND MENTAL.

13. MATTER, MOTION, MIND.— In the two preceeding chapters we have derived matter, from the universal law of difference-relations, as the most fundamental and necessary of general truths. It is the one thing, the only space relation, and in which we are to look for the other things. Now we have a vast number of other things to account for; so we must henceforth regard matter as not only the one universal thing which includes all other things, but the very thing in which it was necessary to create difference in order to create things. So we are now at the point where only the most careful discrimination and common sense judgment will save us from series mistakes. The making of true fundamental distinctions in matter, in strict conformity to the universal law, is highly important, because on these must rest and proceed all the generalizing steps which are to reveal the true system of the Universe. It is all in the right combination of our common sense ideas about things, and let us "don't forgct it."

After long deliberation, in view of all the facts known to me, it seems unnecessary to recognize more than two primary truths of matter, under which all things may be accounted for and arranged in the true order of nature; and which, with matter itself, may be regarded as the three most deep and most general of universal truths They are presented below:—

$$\text{Matter,}\begin{cases}\text{The Motion of Matter,}\\ \text{The Mind of Matter.}\end{cases}$$

Matter being the only space occupant, (or whatever occupies space being properly called matter,) it is therefore the only thing that can have motion. In the same way that we account for motion, we must account for mind. When we are conscious, as in a state of feeling or thought, it is the substance of our nervous structure that feels or thinks, and this we call mind. Our innate common sense should make it impossible for us to overlook the plain distinction of matter and motion, and the same sense experience and judgment may lead us to see the difference between mind and motion.

To avoid some imagined corruption of matter, many have been prompted to ignore this conspicuous distinction, or to assume thatthere is no such thing as matter; nothing but mind.

They would make this ultimate thing (which is undoubtedly a thing of physical sense experience as proved by the fact that it has a prominent name in our language and a place in our daily experience) mind, force, spirit or any other name, but it is always the same thing and to resort to such a useless device is to gain nothing, while it ads to the already exasperating confusion of ideas called philosophy. The law of relativity is very clear on this point. Mind is something, as known in matter by the unmistakable movements of the matter, and in particular in each person by his own conscious states. Being something, we are obliged to class it on the side of actual being along with all the other things, and this ofcourse must be in matter simply because outside of matter is empty space or nothing. To know what matter is, or motion is, or mind is, is simply to notice the difference between it and something else or nothing.

The first step towards a general knowledge of things is to carefully make the primary divisions in matter, in view of all the facts of direct sense experience, then see if the facts or things, not only within the range of sense but beyond sense, can be reduced to order under these divisions. If it seems probable (and it certanly does from this point of view) that all things of the physical universe may be explained and reduced to harmony without the need of anything but Inert Matter in Motion; if there is promise that all things of the mental universe can be explained and reduced to order without the need of anything but the theory that mind is a property of ordinary matter, having the power when conscious, of controling the motion of its own matter, then undoubtedly we have a good reason for making this primary separation of all things into matter, its motion and its mind. For a complete justification of this first category of things we must make the generalizing steps and see the end

Matter, motion, mind, may be regarded as a first Trinity; the three most fundamental of things, united in one thing. Each one is a distinct thing but neither one can be known as it is, without the others along with time and space. Mind can know matter only in its relations to time and space and through material changes due to motion. Mind can know motion only as the motion of matter. Mind can know mind by the difference between the conscious state and the unconscious state in self, and by its peculiar manifestations in the motion of matter, as distinguished from that motion which is governed by the inertia of matter. In spirit life we can know forms of the individual mind through the direct use of the spirit sense. (described in book 2.)

Matter, motion, mind, are not convertable into each other. Matter cannot change into either motion or mind; motion cannot change into either matter or mind, and mind cannot change into either matter or motion. Not being interchangable, they are therefor alike uncreatable and indestructable. Matter can neither be created nor destroyed; motion has had no beginning nor end, and mind has existed in all past time and must continue so to exist in all the future. The truth of the indestructability of matter and motion is now recognized by scientists everywhere. We cannot expect that mind could create itself out of matter or motion, and there is nothing else. If mind exists now, it has always existed, just as matter and motion has.

From the well known facts of mind it is evident that consciousness is not all that exists in it, that there must be an opposite or unconscious state. Our conscious life always contains intervals of unconsciousness, and these breaks are not voids of nothing; neither do they contain something which is not mind. If there is nothing else to be converted into mind, then it is certain that all our intervals of mental inactivity or unconsciousness, must contain mind.

Matter motion mind, are therefore the three foundation truths of the Universe; in which all other things are contained. These three are eternal in themselves and inseparable. We can think of the possibility of matter existing without mind or motion, but we know that this is not true at present and for this reason never has been and never can be. We can think of the possibility of both matter and motion existing without mind, and this likewise is not the case at present and hence never has been and never can be. To think of this complete and orderly Universe as it is at present, and with perfect understanding, we must have these three; and further insight will reveal the truth that these three are all that's necessary to account for everything in this world and in the world to come.

This is the common sense view of the ultimate. It seems utterly impossible that any person capable of ordinary thinking can fail to see the difference between matter, motion and mind, and realize the truth that each one is a real thing, represented in the mind by an idea which is common to all men. These simple ideas have long ago found their way into all human language as a direct result of sense experience, and that they imqly something actually known, cannot be reasonably doubted and has never been disputed by any one but the philosopher.

14. DIFFERENCE, SIMILARITY, TRANSFORMATION, UNIFORMITY.— As a first step toward a generalization of the contents of matter motion and mind, it seems necessary to briefly notice four natural divisions among things on the physical side, thus leaving one large division of things on the mental side. Strictly speaking these are not divisions among physical things. Perhaps more correctly, they are laws of physical activity, neces-

sary to the activity of mind. They are named in the above title.

It is generally understood that we know things by their effects,— by the way they act upon the physical sense organs as in our sensations. The known effect is always in the conscious center of the brain where it is always perceived by self. The thing which has caused the effect is supposed to be outside this center and it may be outside the body or it may be within the body. If outside the body it may act through one or more of the physical sense organs, or it may act through some channel independent of the physical sense. If within the body it may act through nervous matter as when coming from some dominant idea or belief, which has been revived by some mental influence coming from the conscious center. As the outside thing differs from other things, so it is supposed that the inside mental effect or form of mind must differ from other mental effects. But it is well known that the inside mental effects do not always differ in the same way in different people. One person may be badly frightened at seeing a thing which would not frighten another person at all, and some things may taste or smell very bad to one, which would tast or smell good to another. Hence it is belived that our senses are not a reliable means to knowledg. Nevertheless it must be admitted that the physical sense is the only means we have, and to refuse to use it or learn what it really is, is to accept ignorance rather than knowledge. It will appear later that the physical sense, when carefully investigated and correctly understood, may prove to be perfectly reliable in all cases. In a future state and to some extent in this life, we are able to use the inner sense, by which we perceive things directly from the center of self-consciousness and not by the intervention of physical motion. The difference between the spirit sense and the physical sense, will be fully explained in book 2.

The unsophisticated judgment of mankind about the things of the external world, can be relied upon with entire safety. Things are just what they appear to be when we are not deceived by the appearance. The test for a true appearance is found in the often repeated observations of a large number of people possessed of common sense or not biased by education; and the result is generally in favor of this view of the matter. This view has been turned down by the philosopher who holds that we do not know any thing but the effects in mind. But let us keep right on until we get our system with all its harmony, consistency and necessity, then it will appear that common sense is right so far as it goes, and that the philosopher is not in it. The necessary individuality of the conscious mind, and the fact that a conscious state is possible only in the presence of a plurality of things, would make it necessary that matter, should exist in a condition of minute division, in order to permit the existence of the difference upon which the existence of things depends. Or in other words, it is necessary that space (which must be an object of consciousness though not a thing in the sense that matter is) which is everywhere and always the same, should be intimately mixed, as it were, with matter, so that the two, space matter, shall be always present in contrast to the reasoning mind; and also, so that matter through its motion may be able to assume the great variety of forms, and go through the great variety of changes, which are necessary to the existing order of things. That this is the present constitution of the physical world goes without a word, and that matter and motion are capable of producing all the possible sense impressions in mind, simply through their different and changing forms, will appear more and more as we proceed.

It is not difficult to see what would be the result if the universe was nothing but one great mass of matter, absolutely solid throughout, or no division into parts or space unoccupied within its limits. The impossibility of things; the impossibility of life or of the present order, would be a conspicuous fact providing there is any one here to be aware of it. And that this is not the present situation looks like a pointer toward the truth that the universe is a construction which required the guidance of a Supreme Mind. It is therefore assumed that matter, as a simple space and time occupying substance, which may be divided into parts and have motion and difference of motion, thus assuming a variety of forms, is all that would be required for the existence of a world of things like this, so far as difference of form in matter and motion is concerned. It also appears that the law of difference applies to mind as well as to matter and motion. And here is raised a profoundly interesting question. Is it true that the difference in mind (which is so necessary to its very existence) is a direct result of this difference in matter and motion? Or in other words, could the Mental Universe exist without the present form and manner of activity of the Physical Universe? The answer will appear as we proceed, in fact the reader no doubt will have already glimpsed the truth that the variety of shapes and changes which matter assumes in its free space, will be sufficient to give rise to all our ideas about things, whether true or false, and without which we could not think; and that herein lies the true Materialism, which must be the foundation of our Mental Universe.

The next important primary distinction among things is similarity. If we look about us at any time we are apt to notice a number of things which resemble each other more or less. Most people are willing to admit that the two hands which beong to the majority of people are verv much alike, yet there is some difference, and the same is true of eyes and ears and other appendages of the body. We meet a person with two ears, one on each side of his head, and we say, the man has two ears just alike. When we inquire into the matter more scientifically we find that this is the effect which we get in our minds as a result of looking at the man, and that the same thing happens when we look at other things. Hence we infer that certain similarities in the mental effects indicate a like similarity among external things. This, as in the case of difference, is the old fashioned common sense way of looking at things.

This similarity of things appears to be the primary truth on which rests all the clasifications of things which distinguish the several divisions in our knowledge called the sciences. A few simple examples of the application of the law of similarity to familliar things are the following. The eight fingers on our hands are all called fingers because they are alike in shape, in possition and in use; yet there is some difference between each one of them. The thumbs are all thumbs because of their likeness and position, and for this reason they are not called fingers. Each class is thus distinguished from other classes by reason of their several differences, and it is a class because it is collection of similar things, The same is true of many other classes, in fact all classes which the observing person may be able to notice. These classes are not called sciences because they are among the minor divisions of familiar things and have less to do with general methods of research. But they exhibit the truth of the laws of difference and similarity exactly as they apply in the well known method of analysis and synthesis (§3) to the larger divisions called the sciences. Things are first distinguished by their differences. They are then grouped into classes by their similarities. Two things having an equal number of points of similarity are classed together if their similarities are close enough and numerous enough to warrant a class division. Two apples may be known by their difference yet they are classed together because the number of points of similarity in them is greater than in a peach and an apple.

The truth of the laws of difference and similarity may be seen in two general ways; (1) in time—when we may have met with an object yesterday, which looks something like an object we see today, and so we notice the resemblance though the two objects are far apart—and (2), in space, when we see two things at the same time in which we notice more or less likeness between them. In the first case we simply notice both the difference and the similarity between a mental effect or a memory which was acquired yesterday and retained in mind, and the object perceived today. The perception of today and the memory of yesterday, are brought together in the center of self consciousness, hence the immediate sense of similarity. We thus bring things in the mind and things out of mind together and notice their differences and similarities. This is a sort of comparison of immediate perceptions with revived memories which is indispensable to thought. The well informed mind may contain many thousands of such memories, representing many things near and far in time and space. These memories (forms of mind) may be revived in consciousness, and arranged in all possible, true or false relations, (true or false as representatives of the external reality) by self. In this way we think of the past and present in all their true or possible or probable relations to the present or future. These memories are first acquired in physical life directly from the material things by the physical sense, and this is the only way to get them first hand. But when once acquired they are the objective foundation of everything in mind, or that mind can construct, true or false, right or wrong, good or bad. This is a very important truth which should not be overlooked in our study of mind. As explained in book 2, right and wrong thinking is dependent upon this freedom of thought which permits it to make a good or a bad use of these primary physical concepts which are derived exclusively from the primary physical qualities of matter. The Materialism of Common Sense is therefore the only sound basis for human reason.

The next general truth noticeable among the primary qualities of matter is transformation. Besides the difference and similarities in mental effects, which are supposed to be a result of a like difference and similarity among external things, it also appears from the effects they produce in us, that the external things are continually changing. It seems impossible that any one can overlook this obvious truth or fail to see that it is perfectly consistent with the idea of material things moving in space and time. All animals are highly sensative to the slightest change in their environment, and there is a good reason for this sensibility in the fact that danger often lurks in surrounding objects which may be detected by their movements. Transformations of some form are going on continually in the living world, in the dead world and in all the doings of man or animal. If we build a house or a machine or anything, using the most lasting material, it immediately begins to grow old and time is sure to complete its disintegration. The very substance of all things seems to strive to assume the form of soil and then spring into vegetable or animal life.

All our ideas of action, force or energy, are inseperable from the idea of change, A complete state of no change is simply a state of do-nothing, and the most unlearned of people do not fail to see this. As a general thing the more rapib the change or the greater the contrast between action and inaction, the more vivid will be the mental effect. A life without action would be a life of nothing doing, if life at all.

All transformations involve time, that is, they take place in a seriel order, one form succeeding another and so on through all changes. This series is divided into two principle streams as it appears to the individual. (1), the series of effects in the mind, and (2), the series of changes among things out of mind. The mental series is a conscious representation of an assumed or supposed outside physical series. This is the common idea again, which has grown up in the minds of all men as a direct result of experience in this world of matter. It has been called vulgar by the much learned philosopher and the biblical maniac whose imagination gets ahead of his common sense; but his fanatical flights have never shown him a better.

When we speak of transformations among things we are simply talking adout the motion of matter. Things do change, in shape and relations, and to permit this, matter must move. Even the internal changes which give rise to color, taste, smell, to all chemical changes, to heat, cold and the like, must be due to motion; as fully explained later. But here is a question, and a hard one too. What is the cause of motion, or what is it that keeps up these unceasing movements in matter? If we look carefully at the things we see them plain enough and just as plainly we see their motion, and this is all we see. The moon has been swinging around the earth with a steady pace for ages past and yet no signs of slowing up, and surely it is not being pushed from behind. Whatever it is that keeps it going must be inside of it. The common sense man cannot see it any other way because for him, there is nothing outside of matter but empty space. A great deal has been written about force or energy as being the power behind all physical activities; but evidently this power must act upon or through matter and motion, and no one has ever explained how it does so or even how it can be independent of mattnr. The idea of a force, or anything else, outside of matter, is revolting. We of the common brood seem to understand at once and without a hitch that mattsr, as a space occupying moving substance, divisable into parts etc, is all that the conditions under which thought and things are possible, could require. But all this perfect harmony, perfect as far as it goes, lacks something to make it complete; and it must remain so until we find something in matter which is not motion, yet which is necessary to keep motion in the state of continuity so that changes among things may be uninterrupted. Now we are facing the great question of 'what is physical energy?' Modern science has given this questiou much attention and it is not yet settled. That there is something in matter, which, on further investigation, may prove to be the real and sufficient conserver of all physical activities, will appear in § 15 and § 16.

The fourth and last of the natural divisions in the primary qualities of matter is uniformity. While observing the external world through the physical organs of sense we notice that the different effects in mind are limited to a number of regularly recurring series, which indicate a corresponding routine in the several lines of transformation going on in the external world. This is called the Uniformity of Nature, Year after year the seasons follow in the well known and never failing order. The movements of the earth and the planets has been found to be so uniform that when the periodic time of revolution of any of these bodies has been once determined, the results can be depended upon for all subsequent observations, if it has not been interfered with by some external cause. In the sphere of mechanics this uniformity is conspicuous, and that it is limited is equally apparent. A clock can be made to keep perfect time with the movements of the earth, something impossible if the earth's motion was not uniform. We might mention many examples of the truth of this law, and all of which are in perfect harmony with the idea of moving matter in space otherwise empty, and all of which flatly contradict the theory of an external force acting upon matter while all of which plainly indicate the presence in matter of something which will enable us to account for all that our sense experience can show us. There is no place or use, in this philosophy, for an external force; and the same may be said of an external God.

We notice two general departments in the uniformities of nature, (1), that of the external world, which includes everything outside of mind, and (2), that of the mental world, which includes everything in mind. Examples of the first named are given above; examples of the second are found by the thousands in everybodys mind, also in the animal and vegetable divisions of living things. Both of these divisions are external to the conscious center of each person and the one I have called The Physical Universe, and the other The Mental Universe. So far as known to me philosophers heretofore have not recognized this division of all things into those of mind on the one side and those of matter and motion on the other. But from the point of view of this general theory, this division appears to me to be perfectly natural and necessary. Every thing on the physical side readily appears to come under well known mechanical laws, described in coming chapters, while everything on the mental side (vegetable, animal or man,) comes with equal readiness, under some intelligent power, which appears to aim to guide them through a series of changes in which there is a conspicuous course of development continuing through the life of both the individual and the species.

Philosophers have confused the physical and the mental sides of the Universe in a way which would make the above described division impossible. Not only mind but all the different forms of matter and motion, in short all things, are regarded as so many manifestations of the one universal force, which is the "unknown cause of the known effects, which we call phenomena." An easy way of disposing of a great mystery, but not satisfying to those who want to know the whole truth. Under this restriction the theory of Evolution has been admitted as a general truth which would apply to both sidea of the Universe; that is, the evolution of a solar system or a planet, is conducted by the same law which governs the evolution of a living organism. While it must be admitted that in all this we have the clearest evidence of the reign of law, we must not overlook the plain probability that this law is not the same for both the physical and the mental universe. It will be a part of the object of this work to make it plain that the formation of a planetary system or a planet, or any physical thing, is strictly a physical or a mechanical process throughout; and that the true sphere of evolution belongs to the mental side of the Universe: as will be fully explained in book 2.

In the midst of this uniformity in the mental world there is everywhere noticed a certain amount of variation or departure from a strictly uniform course. All plants and animals including man, vary more or less in form of body and in mental peculiarities, during succeeding generations. There is a somewhat similar variation on the physical side. Days and years in their succession are not exact duplicates of preceeding days and years. But the variations on the physical side are not governed by the same laws as are those on the mental side. Physical variations, within certain limits, are perfectly uniform, but mental variation have a much wider range, and on this difference, and on the innate freedom of mind to control the motion of matter, rests the principle of Mental Evolution, (book 2.)

So far it seems perfectly clear that all our ideas of difference, similarity, transformation and uniformity in nature, are in exact harmony with our idea of the one matter as the substance of all things, and of the one motion as the necessary means to the changes among things, and of the one mind as necessary to the contemplation of this perfection. Perfect as far as it goes but not yet complete.

15. INERTIA-CONSCIOUSNESS.— If we suspend by a cord a mass of stone, metal, wood, flesh or any form of matter, and give it a push, it will manifest a certain reaction or resistance

to motion, which is always in exact proportion to the quantity of matter in the mass. When in motion it will swing to and fro, with a certain persistency of motion or indifference to change, which is always in strict proportion to the quantity of matter in the mass. This is rigidly true of all matter so far as human sensibility has been able to observe it, and it has been rightly called INERTIA. In the text books on physics inertia is defined as a property or a law of all matter, which makes it impossible for a body to put itself in motion when at rest, or stop its motion when in motion. When a body is at rest or in motion, and no matter how slow or fast it moves, there is always noticed this total inability to change of state. Careful observation always seems to justify the belief that when motion is imparted to a body it retains the motion until it is transferred to other matter by its direct contact with other bodies, and that a body in motion if launched in space otherwise empty, would continue to move forever in a straight line with the same motion. Great consequences seem to follow inductively from this simple observation. We are lead by it straight to the idea that the total quantity of motion in the universe, like the total quantity of matter, remains constant and that motion like matter is indestructable.

Careful observation will also justify the inference that matter and motion, and all their possible states and forms, indeed all distinctions within them, with but one exception, are known in the purely objective sense; that is, as revealed in their true relations to space, But inertia being the inherent of all matter in all its forms, and manifesting itself not directly to the eye as a form of matter or a form of motion, but indirectly through its effects on matter and motion, and being in itself unchangeable, (with perhaps one exception to appear later) it cannot be regarded as a form of anything, hence cannot be known in the objective sense, or as a primary quality of matter. Not being known as an object, it seems necessary to class inertia as a subjective property of matter like mind.

This is undoubtedly the proper place for inertia in the universal system of things which comes under the general law. Mind or matter, as we shall see, is a two-sided entity or thing, having a negative, static, inactive or unconscious side and a positive, dynamic, active or conscious side; and inertia is its negative side, while consciousness is its positive side. To place the inertia of matter, which to all appearance is the perfect incarnation of deadness, on the mental side of the universe, will no doubt seem wrong to many persons; but a seeming paradox, if carefully looked into may disclose a necessary truth, In order to work out a complete system as required by the laws announced in Chapter 2, it has been found necessary to regard both inertia and consciousness or mind, as subjective properties of the one substance matter; and which properties are convertable into each other. By convertable, I mean that matter may loose its inertia when it becomes conscious, and that the two are interchangeable. This seems necessary in order to admit the power of mind to control the direction of the motion of its own matter. Thus when matter is conscious, it may control its own motion, and is therefore indipendent of the laws of motion which we derive from the inertia of matter. (§16) This is a theoretical necessity which will receive careful attention in book 2.

This static and dynamic side of matter corresponds exactly with the physical and the mental sides of the universe. It will enable us to see the great system of things in its details with more harmony than any other view that seems possible. There is nothing known in human experience more opposite, or more unlike the active willful state of mind which we call being conscious and fully alive to the situation, than this peculiarity of matter which we call inertia. The best examples of action are shown in those mental states in which we are conscious of an aggressive effort in the direction of some object. Those great catastrophies due to the motion and collision of great masses of inert matter, are not a comparison, because they are totally devoid of intellect. On the one side is an active determined or resolute mind, swayed by the will of passion or by the higher faculties of emotion or reason; and on the other is unconscious inertia, entire inability and indifference to change. From the one to the other there is a gradual transition from the most powerful will through mental passivity to complete unconscious inertness. Inertia and consciousness are therefore not the same thing, no more than space and matter or rest and motion are the same things. But it is none the less true that inertia and consciousness, like space and matter or rest and motion, are necessary to each other and could not be known if not so related. So it appears that the principle feature of the active mind is that which marks it off most completely from the inertia of matter, and which is its necessary opposite. To be the opposite of inertia mind must exhibit something of the nature of choice or purpose, which looks to the desires of life; which desires certainly do not run parallel and in harmony with physical laws. The purpose of mind or life is plainly shown in all the states of consciousness, and like every striking fact of the universe it must be two-sided, positive and negative, to give it direction as in purpose. It can be seen at once that all this is just what would be required by the universal law of relations. To have being, the conscious mind must act in the presence of something opposite and different, and the greater the difference or contrast the greater the reality. Inert matter is dead, or as much so as it is possible for matter to be dead. Conscious matter is alive, and that which is alive can be so only in the contrast of the two. The living world and the dead world are thus indispensable to each other and the two must always be together It is not here assumed that matter is dead in the full meaning of the word. Matter must always contain sensability or life potential.

In §14 we drew the line between the physical and tbe mental sides of the universe. It will now be seen that this theory of the relations of inertia and consciousness is in perfect harmony with that division of things. The line must be drawn within matter, which contains all things both physical and mental. The object of this general theory is to establish the truth that all things at all times are under the dominion of laws of matter or mind. In this connection it seems proper to use either of the words matter or mind with the same meaning. Matter is the universal substance of the universal mind; or mind is the thinking power of matter. The laws of matter and mind lie at the bottom of the two sides of the universe, the physical and the mental. On the physical side we have Inertia as the first principle, and on the mental side we have Consciousness as a first principle. From this on to the end of this book we will confine our attention to the physical side, reserving the mental side for the next book, "The Mental Universe."

16. PHYSICAL ENERGY.—When we look about us with unaided sight, or when we penetrate the depths of surrounding space with our best telescopes, we see great numbers of bodies of matter in a state of unceasing motion. All human experience teaches and no philosopher has ever disputed the truth that all sensible matter is in constant motion. In §14 it was mentioned that we have convincing evidence of the existence of something in matter which keeps all things moving. What it can be, science does not profess to know, but its presence everywhere is admitted by all, and it has been dignified by the name energy or force. As mentioned before, we see nothing in it or in the changes going on among things but the motion of matter, and since we cannot think of anything outside of matter at all, nor anything in matter that could play the part of a force, unless it be inertia or a conscious mind, it seems to follow as a clear case of necessity, that we must look for our theory of energy in these universal properties of matter which we call inertia and consciousness. It is now taught in all our schools that inertia is a property or a law of all matter, as described in the preceding section. Even the philosophers have admitted it as the law on which the calculations of physical astronomy are wholly based. We may then offer the following as a legitimate infer-

ence from the inertia of matter and from universal relativity.

Premise.— The only space occupant is matter; all physical activities are movements of matter and all motion persists because matter is inert.

Conclusion.— Physical energy is nothing but the ordinary motion of ordinary inert matter, and the law of its conservation is the law of inertia.

As will appear later we cannot place the conscious mind entirely under physical law. The physical world is a necessary servant, not a master.

The earth (for an example of physical energy, if there is such a thing?) is a great mass of inert matter which has been moving for millions of years past, at a perfectly uniform rate, and the one thing which has made it retain its motion is its inertia. If we ask, how did the earth get its motion? the answer is, from other matter in motion, and so on through all the past matter has been transferring motion from body to body, by contact, the total quantity remaining the same. This is a necessary inference from the above named laws, but so far it is only a general proposition which requires to be verified by some attempt to harmonize the facts and explain the mysteries under it. We must try to find whether all forms of energy are really nothing but forms of motion, with inertia as their conserving law, and this is our object in the following pages.

From relativity and inertia it follows that if all matter was entirely without motion, the universe would be in a state of absolute rest, and this would be a dead universe sure. If all matter had the same quantity and direction of motion, the universe would be in a state of absolute motion, and so far as life is concerned we would be no better off than before. This last named would also be a state of relative rest. In either of these states all matter might exist as a single solid mass, or it might be divided into parts, and if so divided, these parts might or might not duplicate all the existing forms of matter. But in all these states this would be a dead universe, in fact it is quite easy to think of many different material states, unlike the present, but in which matter might possess its present sensability, and even in which some form of spirit life might exist, but in which the present life as we know it on this planet, would be impossible.

But if all or any large part of the universe was divided into parts as at present, and if among these parts there was relative motion or difference of motion, just as we find it at present, then the universe or some part of it, would be in that state of relativity, directly from which comes all things, all changes, and all the possibilities of life as we know it at present. It is only relative motion and relative rest in the presence of such motion that mind can perceive directly. But mind may know absolute rest, absolute motion or in fact any possible state of matter, as a legitimate inference from its knowledge of relative motion, or rather from the effects in mind due to such motion. In all conceivable states of matter there is really but one in which the existence of mind as we know it in physical life, is possible; and this is in the relative motion of the different material forms which constitute the surrounding world. If we were looking for evidence in support of a theory of Design in Nature, we could certainly find it here.

A true conception of motion under relativity, must include our ideas of space, matter and rest; space as the object in contrast with which matter is known and through which it is supposed to move; matter as the space occupant which moves, and rest as the state opposite to motion. It has been said that there is no such state as complete rest; that all matter must be in constant motion. But relativity requires the possibility of a state of absolute rest as the necessary correlative to motion. The possibility of a state of rest admits the possibility of a body having more or less motion and hence difference in motion. Every possible difference in motion may be regarded as a form of motion. Forms of motion are reducable to three classes; (1), the movements of sensable bodies—ordinary motion; (2), wave motion as in sound, heat, light, electricity etc,—insensable as motion; (3), molecular motion as in heat, light, sound, electricity, chemical changes, physical and vital etc,—insensable as motion. These classes are not separated by arbitrary lines, and those of insensable motion are purely theoretical. Forms of motion are determined to a great extent by the forms of matter. Thus ordinary motion is known as it appears in bodies of sensable magnitude; wave motion occurs mostly in liquids and gases; molecular motion belongs to the molecules and atoms of ponderable matter while the motion of electricity is confined mostly to the imponderable ether. Solar light and heat in its transit outward from the sun and stars, is also for the most part confined to the ether. Like forms of matter, all forms of motion are changable into each other. As bodies differ in mass or in the quantity of matter they contain, so the quantity of their motion or energy, and consequently the effect of their collisions with one another must differ. This is called the momentum, or the power of matter to persist in its motion. It is a somewhat different name for the inertia of matter. The momentum of a body is its quantity of motion; its striking force; and so the energy of a given mass of matter is more or less as the quantity of its motion is more or less. This important fact is a necessary consequence of the inertia of matter and it affords a mathematical expression of the truth that motion or physical energy is an indestructable something which is quantitatively measureable. To find the energy of a moving body, multiply its velocity in feet per second, (quantity of motion) by its weight or quantity of matter. Since this law is strictly true of all bodies of sensable mass, it should be equally true of not only the molecules which compose such bodies, but also of the units or particles of the ether. This is an inference indispensable to our philosophy From the inertia of matter and from the relative motion and contact of its bodies or ultimate unit, we derive a fundamental law of physical energy or motion, which is set forth in the three following passages.

1. Every definite body of matter, when in a state of absolute rest, will remain so, with inertia proportional to its quantity of matter, until moved by the contrct of other matter in relative motion. When in motion, it will move in a straight line, with uniform velocity, and with energy or striking force proportional to its quantity of matter and velocity, until resisted, changed in its course or stopped, by its contact with other matter, to which its motion is relative.

2. Physical action or energy manifests itself only through the contact of bodies or particles of matter. Every action produces a change of relations, every action has its equivalent reaction in an opposite direction, and in every action motion or energy is transferred from body to body.

3. In every action or transfer of motion, the same quantity of motion lost by the loosing body will be gained by the receiving body; so that energy or motion though always changing in form, in direction, diffusing or accumulating, can never change in kind or quantity.

The first section of the above described law specifies that every change or transfer of motion in matter must occur thru the contact of two or more of its bodies or ultimate units, at least one of which must have relative motion; and all may have such motion or a part may have either absolute or relative rest. It also affords a full and clear definition of the inertia of matter. The second section aims to more specifically set forth the nature of physical change or energy, and the third distinctly affirms the indestructability of motion or physical energy. It will be seen that this law is a clear deduction from the laws of relativity and inertia; and that there is nothing in physical energy but the motion of inert matter. It might be called the law of inertia, the law of the conservation of motion or physical activity, or its separate sections may be regarded as specifying separate laws of material activity. Fundamentally it is the one truth which underlies and governs the physical side of the universe.

But here is an important consideration. From this law and from the inference that matter cannot be created or destroyed it follows that the universe has always been in motion, at least somewhere and that motion like matter is indestructable. If all things must exist in matter, and if matter has no power in itself to create or destroy its own motion; always transferring it by contact from body to body, without decreasing the total quantity, then the universe always was, and always must remain, just as we find it at present, in motion. On the other hand, if all matter was in a state of absolute rest, or almost any state but the present, no power would exist to give it motion or create the serial order of changes necessary to consciousness in physical life. This conclusion inevitabley follows from the above described law, and we are at once led to the question, is inertia the governing law of the whole, which determines the fate of all things both physical and mental? As already mentioned, inertia and consciousness are both properties of the one substance which we call matter or mind; that they are convertable into each other, or rather the one disappearing when the other appears, and hence that when matter is conscious it is not inert, and so may control its own motion thus being able to act for self as in ordinary conduct, and thus to some extent being independent of the law of inertia. If this power belongs to the life of a planet it may also belong to a Supreme Spirit, and so there would be a power above and superior to the inertia of matter and which at times may interfere with it so far as to control the direction of motion just as we do within our own bodies every day we live. It is not here assumed that this power is almighty or independent of matter or that it can exist out side of matter. Neither does it create matter or motion or anything but forms of matter, forms of motion and forms of mind. We can learn all about it by the proper study of our own minds and this part of our subject will be attended to in the next book.

17. WHAT SCIENCE HAS DONE FOR THIS PHILOSOPHY.— Our theory so far developed, plainly indicates that physical energy is nothing but the motion of inert matter, and that the law of its conservation is the law of inertia. It will now interest us to know what science thus far has done to uphold or refute this theory. It is not known to me that any one heretofore has attempted to work out the theory that the motion of inert matter is all there is in physical energy. But it certainly seems plain that the progress of modern physical science has been steadily in the direction which tends to confirm this theory as a truth. The theory of the "Conservation and Correlation of Forces" as now worked out by Grove, Helmholtz, Mayer, Faraday, Carpenter, Lebig, Joule, Thompson, Tyndall, Youmans and others, has been generally accepted by scientists as an universal truth; though its application in several places is not yet in sight. A

brief account of this law is given below.

At the present time it is claimed that there is but one kind of energy in the universe, and that like matter, this one universal energy is indestructible. To our organs of sense this energy appears in a number of forms which we call sound, heat, light, electricity, magnetism, chemical action, sensible motion, etc; and it is claimed that mental or vital phenomena should be included in the same class. These forms of energy are believed to be interchangeable: any one form may change into any other form. They are also supposed to bear a constant relation of quantity: any one form can give rise only to its equivalent of some other form, and so on without end, the total quantity in the universe remaining constant. A great deal of experimental evidence has been offered to justify this conclusion. Both the interchangeability and the quantitative relationship of these forms of energy are now regarded by many able scientists as established truths. These results may be found in numerous books on this subject and need not be described here. So far as this line of research has been pursued all its results appear to me to justify the theory here advanced. In fact, it is already believed by the majority of scientific men that sound, heat and light, are nothing but forms of motion; and of late years the belief is rapidly spreading that electricity and magnetism will soon fall into line with the others as forms of motion in the ether.

A few examples of the transformation and persistence of the forms of energy may be mentioned here. In the case of a sensible body falling from a high place, it is supposed that the force of gravity is changed into sensible falling motion. But as to the nature of the force of gravity in itself, or the manner of its change into falling motion, science does not claim to know. Newton, about 200 years ago, discovered the law of gravity, or more correctly the law of its variations, but confessed himself unable to divine its cause. To the present day it seems that no advance has been made toward a solution of this mystery. Men of reputation do not profess to know what force is or what the nature of its transformations. When the falling body strikes a solid surface its falling motion is supposed to change into sound and heat, and in some cases electricity is produced. The sound thus generated is diffused in surrounding matter and is soon lost to all human tests, but not to the universe, for it is supposed to change into other insensible forms. As will appear in the next chapter it contributes to the general expansive force of the medium. If the heat produced by the falling body is intense enough, a portion of it becomes light, which is diffused in the same way that sound is. If the electric current generated in this way, or in any other way, is conducted thru a wire which is coiled around a bar of soft iron, the iron will manifest the magnetic force. Heat, light, electricity or magnetism may either of them give rise to chemical action, that is, change into it, and chemical action may turn itself into any of the other forms of energy.

Now it may be seen that all this (here only briefly mentioned) is in complete harmony with our theory of inert matter in motion. It is also clear that the transformation of physical energy is nothing but the transfer of motion from one form of matter to another, exactly as required by the laws of the communication of motion, which we derive from the inertia of matter. For example, when the falling body strikes a solid surface its falling motion is arrested and a part of it is changed into sound by the shock of impact; which sound is wave motion in the atmosphere. Another part may become heat, which is supposed to be a vibratory or shaking motion of the invisible molecules of the falling body and of the surface on which it strikes. All these changes and the equivalent relations among them have been proved by a great deal of experimental research, and today it would be difficult to find a well informed person who is not willing to admit that sound, heat, light and even electricity, magnetism and chemical action, may be nothing but forms of motion in the ultimate particles of matter. But the majority of the people who are occupied with business or pleasure, or getting to heaven, do not seem to be aware of this wonderful progress of modern science. They ride to business or to church on the street car, and they feel the motion of their bodies as they glide along, and perhaps some of them feel like resenting the noise, but few of them ever think of the fact that their motion is transformed electricity, which itself is motion coming direct from the dynamo through the wire, and that the dynamo is moved by the engine, which in turn gets its motion in the form of heat from the steam, which steam gets it from the chemical combustion of the coal, which coal has received it long ago as transformed light and heat from the sun, stored in the tissues of plants by the agency of living matter. All these contrivances or agents are simple means of changing the form of physically guided motion from one to another, until we feel it while we ride and think of the good things of earth and heaven without a thought of how we get them.

All the activities of living matter as they appear in the phenomena of life, are directly dependant upon the forms of motion above mentioned. Life on this planet would be impossible without heat and light, and electricity and chemical motion are also necessary to it, though less conspicuous. At first it was generally believed that all the manifestations of life are forms of the one universal force, like sound, heat or light, etc. Mr Spencer up to 1903, in his 'First Principles' advocates this view. He says on page 211. "Even after all that has been said in the foregoing part of this work, many will be alarmed by the assertion that the forces which we distinguish as mental, come within the same generalization. Yet there is no alternative but to make this assertion; the facts which justify, or rather which necessitate it, being abundant and conspicuous". On page 217 he says. "How a force existing as motion, heat or light, can become a mode of consciousness, these are mysteries which it is impossible to fathom." In the sixth edition of his work 1902, it seems that Mr Spencer has retracted somewhat from the above, as appears in the following. "But now, reverting to the caution which preceeded these two paragraphs, we have to note, first, that the facts do not prove transformation of feeling into motion but only a certain constant ratio between feeling and motion; and what seems a direct quantitative correlation is illusory."

The idea that mind and motion are forms of the same universal force did not advance as rapidly as the idea that sound, heat and light are forms of motion, and very likely the reason is, that it is contrary to common sense. Experimental research so far has done nothing to justify this idea while all of its results have helped to confirm the theory that all truly physical manifestations are movements of inert matter, which must be united by a general law. The line which we have drawn between the physical and the mental sides of the universe is therefore sustained by scientific research in a way which cannot be overlooked by the philosopher.

But scientific research has clarly shown that mental things are all directly dependent on the motion of matter; in particular those forms of it which are confined to the ether and to the molecules. A motionless universe would be unproductive of physical life. It therefore seems scientifically certain that all that science has done so far, is in support of the theory here advanced, viz. that physical energy or force is nothing but the motion of inert matter, and that the laws of its transformation and conservation, are those described in §16.

For these and other reasons to appear later it seems that we must look to mind for the real energy of the universe.

18. COMMENTS AND CONCLUSION.—We can now ask: What are the next steps necessary to reach the goal of philosophy? If science and common sense can make an indisputable stand for the truth of the theory that all physical activities are movements of inert matter, governed as described, then evidently we have only to push forward with a careful review of all the facts as given in modern text books on physical science, to see if certain well known mysteries can be explained and brought

into harmony with the facts of science and under the described physical laws. (§16). All the mysteries of the physical universe known to me are found in the three divisions of physical science called Astronomy, Physics and Chemistry; and they are carefully considered in the four remaining chapters of this book.

Under the head of Astronomy we have to consider the nature the universal substance called Ether; the form and mode of activity of the Atoms and Molecules of sensable bodies; the cause of Gravitation or Gravity; the cause of the Tides, of Sun Spots, and the great mystery of Comets. Under Physics there is the intricate and numerous facts of Electricity and Magnetism, among which there is a great deal of mystery. Under the head of Chemistry there is a much more complex and mysterious class of facts which involve the most intimate relations of the ultimate units of sensable bodies, with each other and with the ether in which they are always immersed. In the last chapter we are to deal with the universe at large and inquire into those far reaching questions of its past, present and future history, with reference to life, here and hereafter. And finally, the greatest of all questions, (is the present form of the physical universe a result of chance, or is it a product of intelligent design?) will be carefully and reverently scrutinized. So there is plenty of hard but highly interesting work before us.

Now I wish to make an earnest appeal to my reader who has followed me so far, and who has not sold himself to one of those phantasms of idealism, to read the following chapters in view of what has gone before, and then compare it with the views now commonly held by those philosophers and religionists who can see nothing in the universe but the one all pervading Force, Mind or God, and who make no effort, nor ever seem to think that an effort is possible or necessary, to distinguish, analyze, and construct the simple things of everyday experience into a most perfect and beautiful whole, which reveals more completely the wisdom of the Supreme, than any invention of the know nothing but force specialist. I would ask him to think of the following manifesto of philosophy, and then seriously ask himself; is this philosophy?

"We come down, then, finally to Force, as the ultimate of ultimates. Though Time, Space, Matter and Motion are apparently all necessary data of intelligence, yet a psychological analysis (here indicated only in outline) shows us that these are either built up of, or abstracted from experience of force."

I cannot find the psychological analysis which would justify this proposition. To come to a final like this is to ignore the most striking contrast in human experience; namely that which always happens in the direct contact of a mass of living, sensative, conscious matter, with a mass of inert and lifeless matter.

That modern philosophy has been lending a helping hand to the new forme of idealism is very evident. The new Christian idealism, miscalled a Science, and which is now making rapid strides to conquer the world, claims to be justified by both science and philosophy. A recent defender of this new religion puts the situation in these words.

"This idealism is by no means out of the line of the tendency and trend of all modern thinking, although in advance of it. No one can have failed to note the increasing emphasis that is today being laid on the powers and possibilities of thought, and in every department of learning the tendency is more and more away from a material to an immaterial basis, away from a physical toward a metaphysical explanation of things. The scientific investigator of so called physical phenomena is today telling us that matter is not what it seems to be; that Matter is explained and is explained away. We are told that the real substance of things is not matter but force. What we eall matter is really the manifestation of negative electricity having the properties of so called matter."

It is not clear to me how a force can have all the properties of inert matter; and this looks like another case of confusion of ideas, so common to this class of thinkers. The fact is conspicuous that all these people admit something, which the common sense of mankind calls matter or substance. But through either a foolish prejudice against the word matter; or through a total inability to systematize their common sense ideas, so as to reveal a proper and necessary place for not only that real space occupying thing which we call matter, but for motion, and mind, and everything else known to common sense; these people fail to see the simple truth. It is in the systematic arrangement of the common things, that we must look for a complete solution of this problem. Let the reader remember this and not only make a note of the clear distinctions which the human mind has already made among the simple things of universal experience, and to which we have given names, but in particular let him notice whether we are able to explain the well known mysteries of mind and matter. The certain test for the truth of any theory is found in its competency to explain the mysteries and harmonize the facts.

The method of analysis and synthesis described in § 3, has been recognized by all scientists and philosophers so far as known to me. It applies to any object of scientific inquiry and it first separates the components of such objects, observing carefully all their inherent qualities, modes of activity and relations to others of their class, etc. Then it puts them together in the combinations which will reveal the harmony and account for the facts which the rational mind of man naturally looks for under the first principle of logic; 'Consistency or Necessity'. The religious idealist cannot look at the matter in this light perhaps because he has inherited too much of that Hindo Mysticism which seeks God by the emotion of desire and humiliation. His yearnings for the divine essence occupies so much of the precious time which God has given him in which to develop his mind, that he has no time to think of the simple material things which are continually pelting him and crying for his attention.

This whole problem may be presented in one brief paragraph, and in the simplest language, and it is all in the harmonious relations of time, space, matter, motion and mind. The following distinctions are unavoidable to sense experience, and they are at least far more consonant with a scientific classification of things and their necessary relations, because they plainly show us a disinction of kind between matter, motion, and mind, and that time and space are objectively necessary to this distinction of the three, and hence all their possible forms, relations, changes, and duration; and that time and space are not in themselves, things, as we regard the forms of matter, motion and mind. Notice that I use only the common words of every day experience, with things known to everybody, in the following passage.

Any definite portion of matter or substance, may exist without motion, but motion cannot exist without matter. Matter may have any definite form, without motion or change of form, but motion cannot have form, or even being, without change. Motion may be added to a given quantity of matter, without increasing its quantity, but matter cannot be added to matter, without increasing its quantity. The quantity of matter, which represents a given quantity of motion, may change, without changing the quantity of motion; likewise, the quantity of motion in a given quantity of matter may change, without changing the quantity of matter. But all this would be impossible if matter and motion were only different forms of the same thing. The difference between matter and motion, and their relations to each other, is therefore certainly not the same as the difference between forms of matter among themselves and forms of motion among themselves. Now almost exactly the same argument will apply to the difference between matter and mind. Any definite quantity or form of matter may exist without conscious mind, but the conscious mind cannot exist without matter. Matter may have any definite form, or many forms, of motion or mind, but no form of mind can exist without matter, nor can it be conscious without the motion of matter. Conscious mind (or forms of mind which may be conscious or unconscious) may be added to a given quantity of matter without increasing its quantity, but matter cannot be so added without increasing the quantity of matter. The quantity of matter or motion in which a definite mental organism is contained, may be increased or reduced without increasing or reducing the mental organism; and on the other hand, the mental organism may be enlarged or reduced within certain limits without increasing or reducing the quantity of matter or motion. But all this would be impossible if matter, motion and mind were only different forms of the same thing. This difference in matter, motion and mind, not being a difference of form, we must regard as a difference of kind; and to say that these three kinds of being are not changeable into each other, is to say that they are unchangeable; eternal in themselves, for there are no other kinds of being as shown in the following final analysis:

The change of matter, motion or mind, into time or space, is, of course, unthinkable. The one alternative for us, is simply this: We must find all things, in the one thing Matter, or we must give up the search. From our definition of things (§1), it follows that, to define anything, is to distinguish and describe all its differences and relations. When we have done this, we then know what that thing is in the most ultimate sense of the word knowledge. All differences in matter (things) admit of a primary classification as follows:

A. Difference of Kind: (1) matter itself, (2) the motion of matter, (3) the mind of matter. These three, matter, motion, mind, are indestructible: they cannot be created, destroyed or changed into anything else.

B. Difference of State: (1) states of rest and states of motion in matter (on the physical side); (2) states of unconsciousness and states of consciousness in mind (on the mental side). The opposite states of matter are changeable into each other, and so are the opposite states of mind.

C. Difference of Form: (1) forms of matter and forms of motion on the physical side (all changeable), (2) forms of mind or mental elements, conscious or unconscious, on the mental side (also changeable).

All matter is inert when it is not conscious, and when it is conscious it is not inert. Inertia is the prinary law which governs the physical side of the universe. Conscious mind is the only free agent or real energy in the universe, and its freedom or power depends upon this interchangeability of inertia and consciousness.

These distinctions and classes are the most simple, the most common and the most general that can be thought of, and they are offered here as the A B C of philosophy. The four remaining chapters of this book and all of the next book will be occupied with a careful explanation and defence of this fundamental division of things.

CHAPTER FOURTH.

MYSTERIES OF ASTRONOMY.

19. **Primary Divisions in matter and Motion.**— In this chapter we are to apply the physical laws described in the preceeding chapters, to the mysteries of that part of the science of astronomy which concerns our planet and the solar system. To facilitate the work it will be best to notice certain large divisions in matter and motion.

First regarding matter. The substance of the universe may be divided into two large divisions, named as follows; (1), ponderable matter; (2) imponderable matter. Ponderable matter is all that which has weight, as appears from the force of gravity. In this division are the three subdivisions known as solids, liquids and gases, and which constitute all bodies of sensible magnitude. The smallest portions (ultimates) of ponderable matter, according to the atomic theory, are called Atoms. Aggregates of from two to several hundred atoms are called Molecules. The atoms and molecules are too small to be distinguished by the human sense, but their existence is conceeded by the majority of scientific men, on the ground of well supported theory. All the knowledge we possess of them, is, and necessarilly must be, theoretical, for the simple reason that they must exist beyond the reach of sense experience. But this knowledge so far as it goes, appears to be entirely satisfactory. All credible or scientifically acceptable theories of chemistry, require the existence of matter, as the space occupying thing of which the molecules and the atoms are made. The theory of Boscovitch, which assumes the existence of centers of force without extension or space occupancy, if true, is admitedly a truth which the human mind will never be able to understand; and with such theories we have nothing to do. The stars, planets, satelites, comets, meteors, nebulae and all sensible bodies, are composed of the insensible molecules, and these again of the atoms, which latter, are the ultimates of ponderable matter. The movements and mysterious relations of all these bodies will be carefully considered as required by physical laws. (§16)

Imponderable matter is all that which forms the great body of Ether which is supposed to fill all space in the universe not occupied by ponderable matter. The bodies of ponderable matter being constantly in motion in all directions must move through the ether. Hence the ether must also be composed of units or small individual particles. The wave theories of light and heat are the only theories at present acceptable to science, and the ether is supposed to be the vehicle of this wave motion. Waves of light and heat traverse the star-strewed space in all directions and cross each other at all points and in all possible angles; hence the ether must exist and it must consist of units which have individual motion. This much is now admitted as at least scientifically probable.

Now, the only assumption, made or required in the present theory regarding the ether, is simply this: The ether medium consists of exceedingly small particles of real matter, possessed of inertia, motion and therefore momentum and all the mechanical properties of ordinary matter, thus making it a subject of the same mechanical laws. The ultimate particles of the ether must be many times smaller than the smallest atom, and the space between them must be empty in order to permit them to move with perfect freedom. Granting only this, the way is then open to a mechanical explanation of every one of the mysteries of the physical side of the universe.

These units of the ether are not required to have weight or any mysterious power of attraction or repulsion, for themselves or for other forms of matter. This substance in the present theory, must serve as the mechanical cause of weight or gravity, also all the so called forms of attraction and repulsion, as those of electricity, magnetism and chemistry, and it must behave exactly as required by the physical laws described in §16.

These two great divisions of all matter, and the proposition that all is governed by the same laws, should be carefully remembered by the reader as an aid to understanding what follows in coming chapters.

Next regarding motion: The laws of inertia and relativity require that all motion should be communicated from body to body by contact and in the form of impact or pressure; and all bodies or particles thus moved must obey the strongest impulse and move in the direction of least resistence. The same thing should be true of all discreet portions of matter, from the largest ponderable mass to the smallest particle of the ether, and the bodies must come in actual contact, directly or thru intervening bodies, for there is no transfer of motion thru empty space. When the motion of a sensible body is resisted or stopped by its direct contact with other bodies, more or less of its motion will be transferred and so will continue as pure motion, but it may change to other forms, as sound, heat, light, electricity, chemical changes and gravity or falling motion. The pressure of a liquid or a gaseous medium, directly or indirectly, should result from the motion and impact of its smallest units upon each other and upon the surface of larger bodies, and these small masses of matter should obey the same physical laws that govern larger bodies; but being much smaller they should move with far greater velocity. If the pressure of such a medium be equal on all sides of a ponderable body, the body will not receive motion from the medium. If the pressure is greater on one side than the opposite, the body will move in the direction of least pressure. From which it follows that Gravity, or falling motion, the upward motion of bodies in air, water, or in any liquid or gas, a vessal sailing before the wind or any object moved in the same way, the moving parts of a gas or steam engine, electric and magnetic attraction and repulsion, chemical affinity or any motion of mass or particle which arises within and by a liquid or a gaseous medium, ponderable or imponderable, should be a direct result of the impact or pressure of other matter in relative motion.

These propositions follow directly from the truth that inert matter in motion is the only space occupant on the physical side of the universe. If they are true it must prove with equal certainty, that all the mysteries of the physical universe, along with all the facts known, must, or at least with a high degree of probability may, form one complete system harmonious thruout; and that we ought to be able to trace it out in all its complicated and obscure parts, by following the laws and suggestions given above. In the next section we will put this general proposition to a first and severe test by applying it to the mystery of Gravitation.

20. Gravitation.— This is one of the recognized forms of physical energy. It will directly produce motion and this motion may change into sound, heat, light, electricity, magnetism, chemical changes and any form of sensable motion. Under the name gravitation it is supposed to govern the heavenly bodies thruout the universe, while gravity is confined to bodies at the surface of the earth. I will here use the word gravity in both cases. About 230 years ago Sir Isaac Newton discovered the law of the action of gravity; and this law being well known need not occupy our attention at present, since it is the mystery that we are now after. It is now generally known that the one great mystery about gravity is its cause. How does one body act upon another at a distance, causing the two to come together? How does our sun act upon this earth, or the earth on the sun, thru over 90 millions of interveneing miles, thus keeping the earth continually circling around the sun? If not for this enormous power the earth would certainly obey the first law of motion and move off from the sun in a straight line. As required by the law of the "Correlation and Conservation of Forces," (forms of motion, §16.) how does the other forms of force or

motion change into gravity, or how does gravity change into the other forms or give rise to falling motion? This is the mystery of gravity, and evidently its solution must have an importent bearing on the law of the Conservation of motion.

If our general proposition is sound, if the only space occupant is matter, if all physical activities are movements of matter and if all physical motion persists because matter is inert, or, in other words, if physical energy is nothing but the motion of inert matter, the law of its conservation being the law of inertia; then gravity or falling motion can be only a form of ordinary motion, due to the transfer of motion to the falling body from some other form of matter. And the explanation of this mystery should simply consist in showing how the transfer may take place. So here goes.

We begin with the sound proposition already derived from the inertia of matter and from the law of Universal Relativity (§8) that the ether is the universal medium in which all ponderable matter is immersed, and that it consists of exceedingly small particles of inert matter, densely crowded together in the space not occupied by ponderable matter, and which particles have empty space between them and are not so close together but that they have plenty of room for free motion through distances perhaps many times their own diameters. This substance must be the medium of radiant motion which is emitted from the stars, the sun and all ponderable bodies, and the motion from which proceeds outwards in all directions, crossing at all points and in all degrees of intencity. Besides this wave motion there is necessarilly an individual motion of the particles themselves, upon which the general tension or expansive force and pressure of the medium depends. Moving in space otherwise empty and not encountering anything but neighboring particles, the units of the ether must describe straight lines with uniform velocity, until they strike each other or ponderable atoms. Following each collision is a change of direction and each particle being perfectly solid, no motion can be absorbed. This form of the ether unit precludes the possibility of these particles performing any action but that which may result from their motion and collisions, and this action can be nothing but a mechanical result of the motion of inert matter. This is a point which should be remembered. Now as mechanical results of the motion and collision of the inert particles of such a medium, we have the following in the order stated.

(1). The diffusion of motion from ponderable bodies outwards thru the medium in all directions. (2), The expansion of the medium, due to the diffusion of motion. (3). Enormous pressure of the medium in all directions from all points within its limits, as a result of its expansion. (4). To prevent the diffusion and separation of these units into a boundless space, this great body of ether must be confined to a limited space which is enclosed on all sides by matter which is incapable of receiving its motion and therefore capable of resisting its outward pressure. As the universe itself must be limited according to relativity, (§8) so the ether must be limited according to the laws of motion. (§16). In chaqter 7, this theory of a limited universe will be carefully examined and completely justified.

Within this limited material enclosure the ether medium should exist in a high state of tension, proportional to its unchanging quantity of motion, and should therefore exert great pressure in all directions from any point within its limits. In this medium the ponderable bodies are always immersed and the medium must exert pressure on all sides of these bodies. If all sensable bodies and larger, were solid thruout, they would be destitute of internal relative motion and so would impart very little or no motion to the ether. But if such bodies were composed of atoms and molecules in constant motion with velocities proportional to their mass, (as required by the laws of motion) they would then impart motion to the ether. Two forms of this motion may be inferred from physical laws; (1), a wave motion through the ether, as in light, heat or electricity, and (2), a confused motion of the particles as in ordinary heat and electricity. (§28), It is now an established fact of science, that all forms of wave motion, diminish in intensity when the distance thru which it travels is increased at the following rate. If the intensity of light, for example, falling on a given surface at the distance of one foot, one mile or one million miles, is called one, its intensity at double that distance would be one fourth; at three times that distance one ninth; and so on. Or in other words, if the quantity of motion in a cubic mile of ether at one million miles from the sun is expressed by the number four, the quantity at double that distance would be one. This rate of decrease follows from the fact that motion radiated from a center outward in all directions, must diffuse itself thru four times the space after doubling its distance, and so being communicated to four times the quantity of matter, (or at least to the matter which occuqies four times the extent of space) must be proportionally reduced in intensity. This ressult comes direct from the law of the Conservation of Motion. (§16).

It follows from the same law that the density of the medium at different distances from a radiating body should bear a constant relation to the quantity of motion it contains at such points—the more distance and less moton the more density and the less distance and more motion the less density. From which it follows that if we could travel outward from our sun in any direction we would meet with a uniform increase in the density of the medium corresponding to the rate of decrease in the intencity of the suns radiation. Proceeding in this way we would eventually reach a point in the ether at which the intencity of the light and heat would be about equal from all directions. This would be a region of greatest density of the ether between star and star in those parts of the heavens in which the stars are about equally distributed. From this point of view the stars would probably appear as they now do from this earth and our sun might be seen as one of them while the observer would be immersed in perpetual night. At this point the density and pressure of the medium would be about equal on all sides of a ponderable body, and such a body would not receive motion of its mass from the medium in any direction.

We can now begin to understand the mechanical cause of the motion of mass, or sensable falling motion, which we call gravity or weight. It follows from the motion of inert matter in the form of a medium as described, that when the medium is expanded on one side of a ponderable body more than on its opposite side, that the body will move toward the more expanded portion of the medium, as a result of the greater pressure of the medium on its opposite side. The greater expansion of the medium on one side of the body may result from the near proximity of a radiating body of higher temprature on that side. This, in brief, and as required by our general theory, is our explanation of the cause of gravity. The same theory somewhat modified, may be applied to falling motion at the surface of the earth. (§21) As applied to our Solar System, it is supposed that the planets are immersed in the general medium ether, the density of which gradually increases from the sun outward, as a result of the diminishing intencity of the suns radiation at the same rate. The density and pressure of the medium is therefore greater on the outside of the planet. Now the increasing density of the medium, as described, can be readily seen; but it may be more difficult to see the physical source of the difference of pressure necessary to produce the effect of gravity. To make this clear let us suppose, (1), that our sun is situated in the center of a great expanded field in the ether, which extends outward in all directions from the sun, gradually shading into the surrounding more dense ether, and that this expansion in the medium is due to the sun's radiation of motion in the form of light and heat, and perhaps electric waves, and subject to the law of diminution as described. (2), Suppose that the earth is situated in one side of this expanded field at some distance out from the sun. The density of the ether would then be greater on the outside of the earth. (3), Imagine a great circle around the sun and far enough out from the sun to just touch the inside of the earth. Outside of this circle draw another circle just large enough to touch the outside of the earth. Half way between these two circles draw another circle, which should pass thru the center of the earth. (4), Now imagine that these three circles mark the sectional limits of two great spheres, or distinct parts of the medium, each about 4000 miles in periphal thickness, the diameter of the earth being about 8000 miles. The entire surface of the earth is then covered by the ether contained in the thickness of the two spheres, one of which is just inside the other and the outer half of the earth's surface is covered by the outside sphere and the inside is covered by the inside sphere. (5), For well known mechanical reasons the ether must exert pressure equally in all directions from any point within its universal body. Now suppose that the outside sphere, which is between the middle line and the outsibe line, represents a solid sphere, strong enough to resist the pressure of the ether from within. Then we would have a great hollow sphere filled with the ether, with the sun in its center and the earth imbedded in the thickness of this sphere to a depth of one half of its diamiter, the inside of the earth being exposed to the ether within. In this case the pressure of the ether on the earth's surface would be altogether on the side of the earth next the sun, and the amount of this pressure can be learned by subtracting the area of one half of the earth's surface from the area of the whole of the inside surface of the sphere, and by knowing the whole pressure of the medium. (6), Now let us enlarge our hollow sphere until its outer limit is marked by the outmost circle which touches the outmost point on the earth's surface. In this case the pressure of the ether on the inside half of the earth's surface would be the same as before, but the pressure on the outside ought to be much greater for the following reasons. The outside half of the earth's surface must receive all the lateral or sideways pressure of the ether to a depth of 4000 miles, that between the middle and outside lines; and this lateral pressure must be greater than that on the inside of the earth, because the volume of the ether in the outside sphere is greater, and in particular because the outside sphere must sustain by far the largest part of the whole pressure of all that part of the medium within the outer circle, in all directions from the sun. Hence the difference of pressure which results in gravity or falling motion.

But even the above may not be sufficiently lucid as an explanation to some persons. Perhaps the following will help them. All the ether directly between the earth and the sun must exert its pressure so as to keep the two bodies apart. But all that enormously greater volume of the ether which is not directly between the two bodies, yet within the circle of the earth's orbit, must exert its pressure against the outside ether, reacting on the outside of the earth; hence the difference of pressure.

That this is a direct mechanical result of motion, in a medium of inert matter as described, cannot be doubted by any one acquainted with the well known laws of motion. Besides, we have very good experimental to evidence justify this conclusion. A small hydrogen balloon can be made to move toward a vibrating tuning fork, by holding the fork at one side and close to the balloon. A vibrating disk may also be made to attract small objects in the same way, and experiments showing similar results in a liquid medium, have been described. In these experiments it has been shown that the air or liquid is expanded on one side of the body, thus causing less pressure on that side, hence the so called attraction. In chapters five and six this mechanical theory has been applied to electric and magnetic attraction and repulsion and to molecular attraction and repulsion.

All this is in perfect harmony with a general mechanical theory because it shows us that the buoyant force of the medium, which is necessary to hold the planets in their orbits, is a clear result of the sun's radiation of motion. The planets continually press outward against the medium as a result of their centrifugal force, and this in turn is a result of their motion around the sun. But the outside pressure of the medium is sufficient to prevent them flying off from the sun in a straight line as required by the first law of motion; which law, they would obey if not prevented by the greater pressure from the outside.

As we ought to expect, this theory will account for the variations in the amount of the force of gravity due to varying distance. For illustration, if our earth was removed to double its present distance from the sun its gravitating force would be reduced to a fourth of its present amount, because the pressure of the ether on the earth's sunward side would be proportionally increased as a result of the reduction of the intensity of the sun's radiation due to increased distance. There is a gradual progression toward an equalization of the pressure of the medium on the two sides of the earth, as due to increasing distance, while there is a gradual increase in the difference of pressure on the two sides, as due to decreasing distance; and so it is that the law of the action of gravity, as demonstrated by Newton, comes into harmony with this general theory.

All things considered, it seems certain that this theory at least points the way to a final solution of this greatest mystery of the physical universe. If this is the true solution it can be seen at once that the force of gravity is no longer an outstanding power, which has no physical connection with the other forms of force or motion, since its physical character and assimilation with the other forms can be traced out with perfect clearness; for it proves to be unmistakably a form of motion, resulting from the change of other forms into it, and which may itself change into still other forms, the entire series of which being completely and continually under the laws of inert matter, (§16 book 1), when they are not controled by a conscious mind. (§15 book 2).

21. GRAVITY AND COHESION.— In the case of falling motion at or near the surface of the earth the mode of action is somewhat complicated with air and water, which affords opportunity for studying the phenomena of gravity and other forms of so-called attraction, in a different and further instructive light.

The earth's surface is enveloped by an ocean of ponderable gases called the atmosphere and which cover it to considerable depth. The exact depth is not known, but supposed to be something over 50 miles. Its density diminishes rapidly with the elevation, being reduced to one half at 2-7 miles. At this rate a very thin atmosphere should remain at 50 miles, which would disapear entirely at 80 miles. The earth is also partly covered by an ocean of water which is about 800 times more dense than the air at the surface of the earth. These gases and liquids play an important part in the phenomena of weight and cohesion, so must not be overlooked. It is a law of hydrostatics (the inertia of matter) that all gases and liquids transmit pressure equally in all directions from any point below their surface, and which pressure increases with the depth from the surface. For example, the upward, downward or lateral pressure per square foot in pure water, at a depth of one foot from the surface, is equal to the weight of a cubic foot of water, which is a little over 62 pounds; at a depth of two feet twice that amount, and so on. As a result, when a solid body is immersed in water or any gas or liquid, the water will exert pressur on all sides of the body at once, but the pressure on its under side will be greater, because the under side is at greater depth from the surface. In consequence of the weight of the units of gases and liquids at or near the surface of the earth, their density will increase downward; in other words, their pressure will result from the weight and free mobility of their units, and those portions nearest the center of the earth will be more dense because they bear the weight of the superincumbent portions. All space in the universe, except that between the particles of the ether, being occupied by matter, as the density of ponderable matter increases downward the density and quantity of the ether must decrease in the same direction; and as the density of ponderable matter decreases upward or outward, the density of the ether will increase in the same direction. From a radiating body there is also an increase in the density of the ether outward as a result of the diminishing intensity of the radiant motion. From the inference that the ether exists in all space not occupied by ponderable matter, and that it exerts pressure in all directions, (§19) it follows that the more dense, or the greater the quantity of ponderable matter in a body, the greater will be the pressure of the ether on its external surface. For examples, a cubic inch of lead will displace more ether and receive more pressure on its outside than a cube of iron, the cube of iron more than a cube of water, the water more than a cube of cork, the cork more than a cube of air and so on.

From these facts all of which are well based on the laws of inertia, it follows: That a ponderable body of sensable magnitude when immersed in air or in water, will also be immersed in the ether. That the body will displace a volume of air or water equal to its own volume. That the pressure of the air or water, tho exerted on all sides of the body, will be greater on its under side because the under side is farther from the surface. The body will also displace a volume of ether equal not to its own sensable volume, but to its density or to the quantity of matter it contains, and the ether will exert pressure on all sides of the body at once, but the pressure will be greater on its upper side than on its under side, for reasons described. (§20). So it is that the tendency of a body to rise, fall, or remain at rest, when immersed in air or in water, will depend exactly on its own density, as compared to the density of the ponderable part of its medium. For example, if the weight of the quantity of water displaced by a body, when completely immersed in it, is less than the weight of the body, then the body is more dense than water equal volumes compared and it will sink in water. If the weight of the volume of water displaced by the body is greater than the weight of the body, then the body is less dense than water and it will rise in water. In the first instance the pressure of the ether on the upper side of the body is greater than the pressure of the water on its under side, hence its downward motion. When the weight of the water displaced is equal to the weight of the body, then the density of the body and that of an equal volume of the water is the same, and the body will remain at rest between two equal and opposite pressures.

As a further and more detailed explanation we will take the case of a ball of cork immersed first in water then in air. When in water the cork will have an upward tendency and if free to move will be impelled toward the surface of the water. When held in air the cork will have a downward tendency and if free to move will instantly fall. The cause of the upward motion of the cork in water may be explained as follows: The cork is less dense, more porous, and contains more ether volume for volume than the water surrounding it. The ether exerts a direct unequal pressure (cause of weight) on each molecule or smallest portion in both the cork and the water; but the quantity of matter in a given space in the water being greater. than in the same space in the cork, the water will displace a proportionally greater quantity of the ether and will receive a like greater pressure. To this greater pressure of the ether on the water its superior weight is due, hence the cork will be forced upward by the greater pressure of the water on its under side; or, in other words, it will move upward by the indirect pressure of the ether acting thru the water. Thus the upward motion of the cork comes directly from the water in the form of pressure or buoyant force; the water receives it directly from the ether thru that difference of pressure which is the cause of weight; the ether gets it directly from the molecules of the earth and air as radient motion resulting in ether expansion, from which comes the weight of ponderable bodies; and the molecules get it direct from the sun as light and heat. It is thus the same motion thru all its changes.

The downward motion of the cork in air may be explained as follows: The cork is more dense and contains less ether volume for volume than the air surrounding it. The ether exerts a direct unequal pressure on each smallest portion of both the cork and the air, but the cork being relatively more dense will displace a greater quantity of the ether volume for volume, and will be pressed downward with a force as much greater than that pressing down the same volume of air, as the quantity of ether displaced by it is greater. The indirect pressure of the ether acting thru the air on the under side of the cork will tend to prevent its downward motion and will diminish its weight to some extent; also the pressure of the column of ether directly under the cork will tend to prevent its falling motion. But the pressure or expansive force of the far greater volume of ether below but not directly under the cork, will act indirectly on its upper side, hence the falling motion. In this case as in the other the motion is first transferred to the ether medium from the sun as waves; then after traveling to the earth it is absorbed by the molecules; then to the ether as the expansion which gives difference of pressure and finally the falling motion of the cork. In all these changes the motion never ceases to be motion, and it cannot depart from inert matter: so inertia must be its governing law.

Many facts might be mentioned, in fact everything known to me in the physical universe, seems to readily come into harmony with this mechanical theory of gravity. The law of falling motion, which requires the velocity of falling bodies to increase as the odd numbers 1, 3, 5, 7, 9 and so on, showing that gravity is a constant force, acting during the descent of the body as well as at its start, is just what we would expect of a continuous pressure. A stout bottle containing air and sealed water tight, when sunk to considerable depth in the ocean may be crushed by the increased pressure of the water, and it will also loose weight as it sinks in the water. In this case nearly the whole pressure of the medium both ponderable and imponderable, will be transferred to the outside of the bottle by the increased density of the water and greater displacement of the ether immediately surrounding the bottle, thus causing a withdrawal of the ether in the bottle and in the pores of the glass.

The common idea of gravity, now taught in our schools, is that of an attractive force, which exempts nothing material, which acts thru all distances and without regard to intervening objects and which action can only vary as the quantity of matter or distance varies. Now let the reader remember this formulae in view of the familliar facts described below.

The form of attraction called Cohesion, is a feature of all solids, and in less degree of liquids, and it appears to result directly from the contact of sensable bodies, also their molecules, as in cases of welding, soldering, or in the use of pasts, glue and the like. As an example of cohesion, a drop of water will adhere to a small bit of solid matter no larger than the drop, while both are held very close to the surface of the earth. When we compare the great mass of the earth with that of a drop of water, then take into account the relative distances between the three bodies, and the repulsive force which, as shown later must act between each molecule of the water, then we see at once the impossibility of an attractive force acting as prescribed above. A better illustration of the same difficulty is that of mercury and iron. The density of mercury is much greater than that of iron, yet mercury is a liquid and iron is a tenacious solid. To reconcile this repulsive force which maintains the liquid form of matter, and the attractive force which maintains the solid form, and this gravitating force which makes things fall, the three under the above formulae, is, on its very face an impossibility, What we want is a theory that will explain and harmonize all the facts. It seems certain that these and other like difficulties will disappear completely under the mechanical theory. The repulsive force of the molecules will be brought under the mechanical theory in chapter 6, and this being understood the difference between mercury and iron can be seen at once. If the facts of gravity can be brought under this generalization we ought to expect the same of those of cohesion. Let us notice a few cases. When a number of molecules of the vapor of water get together as in a drop of rain, they are held together, not by an attractive force acting from their center or from one to another, but by the outside pressure of the more dense ether in the air surrounding them. The vapor of water is known to be diffused in the air and to be condensed by a reduction of temperature, which is also a reduction of the molecular repulsive force, described later. The molecules then unite at the point where outside pressure begins to outbalence molecular repulsion, and they are held together, not by any attraction acting from within, but by a nearly uniform pressure on the outside; being a little greater on the upper side, as in gravity. Pour a small quantity of water on a smooth dry board of light wood, and notice that the water will not spread over the board but will appear to be repelled by it. The board being highly porous and the pores being filled with the ether, the water is prevented to some extent from spreading over the board by the outside pressure of the ether, as in other cases. But if the surface of the board is wet, its density is then equal to water, and the water spreads because the pressure of the ether from within the board and at the edges of the drop of water, is removed to some extent. Two pieces of cork if brought in contact while under water will not cling together because there is no greater pressure from the ether or the water on their outsides; but when floating on the surface where they are partly immersed in the ether of the air which is more dense, and having a film of water between them, they are then held together by the outside pressure of the ether. The preparation of the sensitized albumen paper used by photographers for printing photographs, requires that the paper be floated on a solution of silver-nitrate in water. The usual strength of the solution is about 50 grains of silver salts to the ounce of water. When the solution is too strong it will collect in small drops scattered over the paper when it is lifted from the solution and held in mid-air, thus spoiling it for use. An increase in the density of the solution beyond a certain point will cause it to displace more ether and receive more pressure on its outside from the ether, which pressure is sufficient to collect the solution into drops as in the cace of rain drops. It is possible to select a series of liquids and arrange them according to their density, so as to reveal this difference of pressure very clearly. A drop of sulphuric ether, one of the lightest of fluids, if placed on a flat surface, will spread out nearly flat; a drop of water, more dense, will not spread so much; a drop of sulphuric acid, still more dense, will spread much less; a drop of mercury, the most dense of fluids, will assume nearly the form of a sphere.

We might mention hundreds of similar cases all of which seeming to reveal the true relationship of the ether and ponderable matter, as required by physical laws (§16), while they flatly contradict the truth of the idea of gravity or cohesion as an attractive force acting as described. These cases appeal directly to the common sense of mankind and to say that they are suggestive is to state the simple truth. The following experiment appears to go right to the mark and might be regarded as a demonstration.

Take two plates of glass when perfectly dry and clean, place them in contact side to side and stand them on edge, holding one. The one unsupported will separate from the other and fall. Next dip both plates in water and place them together as before. They are now held together by considerable force. Thus when perfectly dry, nothing but air between them, they fall apart, but with a film of water between them they are held together by a force, which, if explained as an attraction between the water and the glass, is not explained at all. Now remember that water is 800 times heavier than air volume for volume. Hence from the theory of attraction we ought to expect the plates to be forced apart by the greater weight of the water between them; while from the theory of pressure we ought to expect them to be held together by the greater outside pressure of the ether, as in other cases. It will be seen at once that this result cannot be referred to the weight and lateral pressur of the air, because water is much heavier than air; neither will any theory of attraction which does not explain attraction, account for it. The pressure of the ether medium must be much greater on the sides of a body having two parallel flat sides like a plate of glass, than it is at the edges of such a body; and for the same reason a thin film of water or any fluid should have a greater pressure on its sides than on its edges. Hence, when the water is introduced between the plates of glass, as above described, it will displace the air and a large part of the ether within, so that the ether on the outside is more dense, and as a result we have the superior outside pressure. In chapter 5 mechanical reasons will be given for the further support of the theory that the pressure of the ether is greater on the sides than on the edges or ends of ponderable bodies, all of which contain ether more rare than that in the air outside of them. As examples, the electricity (expanded ether §28), imparted to an insulated plate conductor, is more abundant at the edges than in the middle of the plate and it tends to escape at points on the plate as the corners which project into the air. So also the electricity or more rare ether in a thin film of water is forced toward the edges by greater pressure on the sides. All this is intelligible if we admit that electricity is motion in the ether resulting in its expansion as explained later. What we call capillary attraction also falls into line under this theory. The reason why fluids ascend above their level in small tubes and in the pores of solids, is the same as that which causes electricity to escape from pointed conductors; outside pressure of the medium. But the facts of electricity belong to the next chapter.

Without further discussion we may safely conclude, I think, that the general facts of gravity and cohesion, which are inexplicable under any idea of attraction, may be explained and reduced to order under the mechanical theory here described. In all cases of cohesion due to the contact of bodies, a part of the outside pressure of the ether is transferred from the inside or point of contact, to the opposite or outside of the bodies, as due to a displacement of more or less ether between them; hence the cohesion. As long as there is ether between two such bodies equal in density to that outside, there is equal pressure on both sides and hence no cohesion. All of which is fatal to the theory of attraction as given in the above formulae.

22. NEWTON'S LAW OF GRAVITY.— Returning to the facts of Astronomy let us see how far our mechanical theory is in harmony with the law of the action of gravity as defined by Newton. According to Newton's law the amount of the force of gravity in any case, is dependent on two factors: quantity of matter and distance thru which it acts. It is more or less as the quantity of matter is more or less and it decreases according to the law of inverse squares, described in (§20).

It is now taught that there is no limit to the action of the force of gravity,—"that every particle of matter in the universe attracts every other particle", as prescribed above. This statement ofcourse cannot be accepted as true if the mechanical theory is accepted. As already shown this force should be limited to the sphere of radiation of the active heated body. The power of our sun, for example, should extend only to that part of the universe wherein his light is about equal to that of neighboring stars. The force of gravity should depend to a great extent upon the temprature of the radiating body, and is not proportional to the quantity of matter it contains. If our sun, for example, should gradually burn out and grow cold like a stove when the fire goes out, we can infer from our theory that the earth and the planets would most likely draw nearer to the sun for a while, but eventually a point would be reached at which their tangentile force would outbalance the outside pressure of the ether, then they would leave the sun and each pursue a straight course thru the universe. This must be the fate of our system of planets unless there is some means of keeping up the present temperature of the sun. This matter will have our attention again in chapter 7.

Like any confined and heated gas the tension or pressure of the universal medium of ether should be the same at all points in the universe, though it may differ in density at different points as the quantity of motion at such points may differ. The perfect mobility of the ether, its inertia and the laws of the communication and diffusion of motion which comes from its inertia, makes this conclusion unavoidable. The whole pressure of the medium on any ponderable body, must be in proportion, not to the size or volumn of a body, but to its density or to the quantity of matter it contains. (21). From which it appears that the first factor in Newton's law, (quantity of matter) is at least to some extent justified by the mechanical theory. It appears also that there ought to be a definite and constant relation between the quantity of matter in a planet, its velocity in its orbit, its distance from the sun, the density of the ether surrounding it and the temperature of the sun; for in the perfect balance of all these elements would depend the stability of our system of planets.

By observing the changes in the sun's apparent diameter continually during the year, Astronomer's have found that the true form of the earth's orbit is an elips with the sun in one of its foci. This is more or less true of all the planets. It is also known that our system is moving toward the star P, in the constellation Hercules. The perihelion, (or point in the orbit of a planet at which it is nearest the sun) is on the same side of the sun for all the planets. It is not known to me whether this is the side toward which the system is moving; but if it is, the fact would justify the idea of a resisting medium as the cause of the eliptical form of the orbits. But whatever be the cause, it is evident that this eccentricity of the orbits of all the planets is not in harmony with Newton's law, while it seems to agree perfectly with our theory of a mechanically active medium of ether. To illustrate, let us take the motion of the earth once around the sun. The eccentricity of the earth's orbit is 1-60 of its diameter, and in perihelion the earth is about three millions of miles nearer to ths sun than at its opposite point called aphelion. Also in perihelion the velocity of the earth in its orbit is somewhat greater than on the opposite side. Now if we take the earth's velocity for one minute at any time during the year and at any point in its orbit, making due allowance for the motion of the system against a resisting medium, then attempt to calculate its velocity and course for all subsequent minutes, as required by the Newtonian law, what is the result? The earth's centrifugal force on the one side, and the gravitating action of the two bodies on the other, must be equal and opposite all the time, in order to maintain the earth in a continuous orbit. The form of the earth's orbit should be that of a true circle, with the sun's center of mass in its center and the earth's center of mass exactly on the circle; if the law of Newton is true. From this law we can only think of two equal and opposite forces in perfect balance; hence the stability. The slightest deviation one way or the other, means the destruction of the system. The eccentricity of the orbits of all the planets is thus totally unaccounted for by the theory of gravity defined by Newton.

The influence of the planets upon oneanother called perturbation, is another example of the inadequacy of this theory of attraction. If the disturbing effect is due to a direct action between the two bodies, exercised thru empty space, and as required by the definition, then the formulae of this action must be rewritten, for the observed facts do not justify it. It seems strange that these discrepancies could have been overlooked so long. If any one else has noticed them, I am not aware of it.

Now if we look at our Solar System with its massive planets, whose orbits all have more or less eccentricity, and which planets are continually subject to irregularities due to their action upon one another, and think of the perfect stability of the whole, thru immense periods of time, it is certainly not very easy to understand it as due to an incomprehensible attractive force acting thru a perfect void and as required by its definition. But if we simply fill this inter-planetary space with a substance, having only the mechanical properties of ordinary matter, just as we have snpposed to be true of the ether, then how easy it is to take the steps of legitimate theory which will enable us to surmount all difficulties, account for all the facts and view our system in its wonderful perfection and simplicity. The perturbation of the planets thru this medium would result from a slight increase in the rarity of the medium on the side of the planet away from the sun, due to the radiation of motion from some outside planet, thus diminishing to some extent the buoyant force of the medium; which force is due to the sun's radiation. The planets are thus held in their orbits by a flexible support, which may yield outward more or less according to the intensity of the radiation from without.

From this brief and imperfect review of the most general facts of Astronomy it appears that the Newtonian law or theory is not alltogether true, or true only in part. It is not true as an universal force acting as described—the sun's action being confined to its sphere of radiation, and so with other bodies. It is not true as a force which depends alone upon the quantity of matter in the two bodies, because it is shown to be a force which depends upon the higher temperature of one of the bodies. But it appears to be true that the weight of a planet will depend on the quantity of matter it contains at a given temperature of the sun and a given velocity of the planet. It also appears that the weight of a planet will decrease as the square of its distance from the sun increases, but as due to the diminution of the sun's radiation at the same rate. These conclusions are not offered as final or absolutely correct. A mathematical treatment of the subject has been impossible.

23. **The Moon and the Tides.**— The periodic rise and fall of the surface of the ocean twice every 24 hours, called the tides, is known to be a result of the gravitating action of the moon and the sun. It seems that we have, in this phenomenon of the tides, the most convincing evidence of the incompetency of the theory of attraction, and of the entire sufficiency of the theory of mechanical ether pressure, as a means to explaining the facts.

The moon being so much nearer to the earth than the sun is, his power of producing the tides is about double that of the sun. The elliptical form of the moon's orbit is the cause of some variation in his distance from the earth; and with this goes a corresponding variation in the tides, it being greater at the least distance and least at the greater distance. At the time of new and full moon, in particular if the moon at this time is nearest the earth, the highest tide will be produced; for in this case the sun and the moon will act together. When in quadrature, the moon's position with respect to the sun is such that the two bodies will interfeare with each other in their action upon the earth, hence the tide elevation shows itself at four different points on the earth's surface, but is lowest of all at any point. The two points of highest elevation are nearly or quite equal and occur on opposite sides of the earth; on the sides nearest and most remote from the moon or the sun. The highest point next the moon is nearly under it, lagging a little behind, and tends to follow the moon around the earth. These are a few of the facts known about the tides, and mentioned here to prepare the reader for what follows. The explanation of the tides from the law of gravity as defined by Newton, is briefly as follows.

The two opposite sides of the earth's surface being at different distances from the moon, by about 8000 miles, are unequally attracted. The water of the ocean on the side next the moon is drawn away from the solid mass of the earth, while the earth is drawn away from the water on the opposite side, hence the bulging out of the ocean on the two sides of the earth as observed in the phenomenon of the tides.

Even if we admit the truth of this idea of attraction, this explanation of the tides by it is beyond comprehension. The mass of the earth is 80 times greater than the mass of the moon. A body placed at a point half way between the earth and the moon would be attracted by both at the same time, but the moon would pull in one direction while the earth would pull in the opposite direction. Owing to its far greater mass the pull of the earth would be very much greater than the pull of the moon; and since every body that moves must obey the strongest force and move in the direction of least resistance, the body placed half way between the earth and the moon would certainly move toward the earth and for that reason it would not move toward the moon. Now if this same body was placed at the surface of the earth, its certainty to move toward the earth would be immensely augmented, because its weight would be immensely increased. Exactly the same thing is true of all matter at the surface of the earth. Every molecule of water in the surface of the ocean is at all times not less than 221,463 miles from the center of the moon, and not more than 4000 miles from the center of the earth. What could be more impossible? Yet this explanation of the tides is now taught by a Yale College Professor. (Loomis's Treatise on Astronomy, page 186).

Even if the moon does raise the water of the ocean in this way, why does it not continue to lift it all the way to the moon, since the least diminution of the distance is an increase in the moon's power of attraction. Perhaps it would be a better explanation to suppose that the feeble attraction of the moon is sufficient to overcome the earth's attraction enough to permit the water to expand by its internal molecular repulsive force, thus swelling up the surface as in the tides. Or perhaps, the moon's radiation may increase the molecular repulsive force at this point thus causing expansion and elevation of the surface. But such theories at best do not more than approach the truth because they do not explain attraction or repulsion. The same dificutly appears in the disturbing effect of the planets on one another noticed in §22; also the effect of the sun upon the moon. The insufficiency of the theory of attraction being apparent, let us see what the mechanical theory can do for us.

The moon and the earth are both radiators of motion in all directions thru the ether, hence between the two bodies the medium ought to be somewhat more expanded than elsewhere. In chapter 5 it will appear that electricity in one of its forms is motion in the ether something like heat in ponderable matter. For mechanical reasons already explained it follows that the ether immediately over and within that part of the earth's atmosphere and the ocean, which is directly between the earth and the moon, must be somewhat more expanded than elsewhere. This would diminish the outside pressure of the ether to some extent, directly over that part of the earth's surface or the ocean and the atmosphere, where the tide elevation occurs, thus permitting the expansion and elevation of the surface of the ocean and the atmosphere at that point, by their internal molecular motion. In this way the tide elevation on the side of the earth next the moon is explained. It should be noticed that this explanation has not been devised to suit this particular case. It is the same mechanical theory which we have applied to the perturbation of the planets, and in slightly modified form to all the facts of gravity and cohesion. It is the one theory for all the facts, and the further we go the more we can see this.

In order to understand the cause of the tide protuberance on the opposite side of the earth it will be necessary to mention certain analogies in electric phenomena, to be fully described in chapter 5. As already mentioned electricity in one of its forms is expanded ether. When an insulated metallic sphere is electrified, its atmosphere of electricity or expanded ether, will distribute itself equally over the sphere, if no other electrified body is near it. But if an electrified body is brought close to the sphere, but not in contact with it, its electric atmosphere will immediately accumulate on two opposite sides; on the side next to the electrified body and on the side opposite. As explained in chapter 5 this form of electricity is expanded ether confined to the surface of the sphere by the outside pressure of the medium. Now it is here supposed that this is exactly what occurs on the earth, on a large scale, in the case of the tides, the moon being the electrified body. As shown in §21, the outside pressure of the ether is greater on the sides of a flat plate or an elongated conductor than it is on the edges or ends. It may be readily seen that the atmosphere of expanded ether which must exist in the earth's atmosphere, would be lengthened out toward the moon as due to the proximity and radiations from the moon, and as due to the greater pressure of the medium on the sides of the two bodies The following analogous cases may be mentioned here. The electricity on an insulated metalic sphere or globe, is always equally distributed over its surface, if no electrified body is near it; but if an electrified body is near, then its electricity always assumes the ellipsoidal form, with its major axis toward the elctrified body. Now on an insulated metallic cylinder, which is longer than wide, the electricity is always at the ends whether an electrified body be present or not. On a plate, it is at the edges; in a steel magnet, at its ends. Supposing electricity to be expanded ether undea the enormous outside pressure of the medium, these facts are at once accounted for. The expansion of the ether on opposite sides of the earth in this way, and as due to the moon's electric radiation, will releive the outside pressure of the ether on the two sides of the earth, thus permitting the water of the ocean to bulge out as in the tides. In this way the tide elevation on the opposite side of the earth is explained by the mechanical theory.

It may be supposed that the moon ought to receive more motion from the sun than from the earth when passing between the two bodies. Hence the question. Why don't the moon fall to the sun when passing between the earth and the sun? The answer is evident in the great probability that the sun's radiation which strikes the moon on his sunward side, has more of the form of light and radiant heat, while the earth's radiation which reaches the moon should have more of the electric form, which latter is more potent in producing the moon's gravity. The electric radiation which maintains the moon in its orbit, tho more intense by reason of less distance, as shown in the tides, is also confined to one point. No doubt these questions may be thoroughly examined by the astronomer with his modern equipment and practical knowledge.

24. THE MOON'S ATMOSPHERE.— Careful observation for a number of years has failed to reveal a sensable atmosphere on the moon. If there is any, it is supposed to be so rare as to fail to produce the twilight effects known to be a result of the earth's atmosphere. Besides, during the many occultations of the fixed stars with the moon, no effect of refraction has ever been noticed, which fact is regarded as proof that the atmosphere of the moon, if it exists at all must be extremely rare. Hence the questions: Why was the earth provided with an atmosphere, while the moon has none? and will the mechanical theory give us any light on the question?

The Nebular theory of the origin of our Solar System, (described in chapter 7,) is the only theory, so far as it goes, that offers a mechanical explanation for the known facts. According to this theory, there was a time long ago, when the earth and the moon formed a single nebulous body, intensely heated and expanded so far as to extend some distance beyond the present orbit of the moon. Thru the usual process of cooling and condensation, due to the radiation of internal motion, and thru the action of the centrifugal force which is due to the present rotary motion, a nebulous ring encircling the equator of the revolving body would be formed and detached from the larger mass in the center which mass is to be the earth. The same cooling process continuing, would break up this ring into smaller parts and these would finally unite to form the moon. In view of the mechanical law of segregation—which requires the integration, first of the heavier elements and afterwards the lighter, according to their atomic weights, leaving the lightest of all on top or outside, and in view of the fact that the moon is now a solid body, tho perhaps composed of the lighter elements, it may be inferred, that since the ring from which the moon was formed contained molecules heavy enough to form solids, it ought to have contained molecules light enough to form permanent gases like those of our atmosphere or even lighter. So it follows from the nebular theory, that our moon as well as this earth, ought to have an atmosphere. Hence another question: How did the moon loose his atmosphere?

When our planet was still very hot and surrounded by an extensive atmosphere of gases and vapors, and when the moon was newly formed and in a similar condition but more advanced toward the solid form, it may be inferred that the expanded ether surrounding both the earth and the moon was in a high degree of electric tension, and that the two bodies bore the relation of positive and negative, the earth being positive to the moon. In this state, stable equilibrium would be uncertain if not impossible. Any unusual disturbance in either the earth or the moon would be an increase in their electric energy. We now have such disturbances in our sun and their effect upon the earth is shown in what we call magnetic storms. The moon being near the margin of the earth's expanded field, would give that field greater length in the direction of the moon. This is an effect similar to that of the tides and it has a number of well known analogies in electric phenomena. The moon's electric atmosphere being negative to that of the earth, any unusual disturbance in the earth would cause an electric discharge in the direction of the moon as its only outlet. This discharge would be the same as any discharge of electricity, experimental examples of which on a small scale may be easily obtained. But the discharge should be continuous, not sudden like a flash of lightning, and it should project beyond the moon, straight into the ether medium, thus carying away and dissipating the lighter materials of the moon which might have remained to form an atmosphere. So it appears from the mechanical theory that our moon ought not to have an atmosphere; that it ought to appear just as it does at the present time.

It was very likely a winnowing process like this which not only took away the moon's lighter materials, which, under the nebular theory would have been left with it, but also prevented it from acquiring a rotary motion as did the earth. When we come to consider the mystery of comets (§26) we may witness at the present day an actual occurrence of the same thing.

25. **THE SUN AND THE PLANETS.**— The central and largest member of our Solar System is the sun. From inertia as the universal physical law it follows that the sun should be the exclusive source of the energy of the system except that stored in the planets and other bodies. All this energy is pure motion, and it persists because matter is inert. The most of it comes directly from the sun in the forms of light, heat and electricity; but on reaching the planets and other outside bodies it may change to other forms, as sound, chemical action, gravity and all the forms of physical activity. It is necessary to all forms of life or mental activity; but there is no evidence that it ever changes into mind. The planets may also react upon the sun or upon each other, by reflecting this motion.

It is known that the tides of our ocean, the meterological changes in our atmosphere and the general magnetic condition of the earth is produced or effected in some mysterious way by the sun and the moon. It is also suspected that sun spots and solar storms are produced or influenced in their number and periodicity by the varying positions of the planets. It seems but natural to look to the ether medium and the mechanical laws which govern it for the explanation of these facts.

The sun is enveloped by an intensely hot and luminous atmosphere of great depth called the photosphere. Sun spots are belived to be enormous depressions or cavities in this atmosphere which expose to view the darker interior of the sun. If we only look at the late pictures of sun spots and read the careful accounts of them, it is not difficult to see that the sun may be immersed in a material repulsive medium, which reveals its presence by its pressure on the sun and by intruding itself into the sun's atmosphere. According to careful measurements the smallest spot that can be seen must have an area of at least 50,000 square miles, while some of the larger ones measure as much as 153,500 miles in diameter and with a depth of 4000 miles. The general appearance of these spots is that of a dark irregular shapedpatch called the nucleus, surrounded by a fringe less dark and called the penumbra. It is now belived to be proved that these spots are great depressions in the sun's most heated and luminous outer atmosphere, exposing to view the inner and less luminous body of the sun; all of which is to be expected from the mechanical theory. Sun spots are most generally found in two zones or belts encircling the sun on each side of the equator and from 8 to 20 degrees from it. They are rarely seen directly on the equator or more than 45 degrees from it on either side. The duration of the spots is extremely variable, some appearing and disappearing in 24 hours, while others have been known to last several months. They also change their forms more or less rapidly and they often appear to move in various directions, in some caces attaining a velocity of 1000 miles an hour. A revolving motion around a vertical axis has been frequently noticed in these spots, which is exactly like the whirling wind storms here on earth. In short, all observed facts so far support the theory of a highly heated atmosphere as described, and clearly subject to mechanical laws.

Now to explain the cause of sun spots according to the present theory we might proceed as follows. The sun revolves upon its axes a little more than 14 times during one revolution of the earth around the sun. The centrifugal force of the sun's atmosphere due to this rotary motion, must be stronger on the equator and from 10 to 20 degrees on either side, than at other points. As a result the atmosphere must tend to accumulate, become less dense and of greater depth on the equator than elsewhere. As another result two shallow zones on each side of the equator would be formed. The atmosphere at or near the poles would have little or no centrifugal force, hence little or no tendency to bulge out or leave its place. Hence the thinning and shallowing of the atmosphere between the poles and the equator would be an inevitable mechanical result, and it is in these zones that we ought to expect to find the sun spots if they are what they appear to be. And this is where we do find them. So far there is perfect agreement between observed facts and mechanical laws. The sun's equator being in the same plane with the orbits of all the planets, there ought to be some reflection of motion from the planets back to the sun. Here we have a noteworthy inference. The changing positions of the planets, their varying distances from the sun, the fact that a number of them are all on one side of the sun at the same time, these facts at once suggest the high probability that a corresponding effect in the atmosphere should be looked for. The near approach of a large planet, or two or three of them in conjunction or opposition, must have some effect upon the sun similar to that of our ocean in the cace of the tides. The diminished outside pressure of the ether on the sun's equator would tend to heap up the atmosphere at this point thus withdrawing it from either side and so permitting the more dense ether at the sides to intrude itself into the atmosphere and so cause the sun spots. A lateral whirling motion of the spot or of a portion of the sun's atmosphere due to the conflict of opposing currents, would make an opening for the ether thus accounting for the whirling spot. This, in brief, is our mechanical explanation of sun spots.

The two sun spot belts on each side of the sun's equator, give us an idea of the beginning of the process which develops the nebulous rings which thru further progress in the same direction may produce a planetary system or a moon system like those of the planet's Jupiter and Saturn. The rings of Saturn, the fact that Jupiter has no belt or dark rift exactly on his equator, the divisions in the tails of comets and in electric discharges thru air, the peculiar and diverse forms of distent nebulae etc, these and other similar appearances, suggest at once the presence of a common cause which is not to be placed outside the sphere of physical law.

Like the hurricanes and tornados of this earth, the sun's atmosphere is also the scene of very similar activities, But solar storms are so much greater in magnitude and violence that those of our small world would be only as a drop in the ocean if compared. The big wind storms of this earth are mostly confined to the tropics or region of the trade winds, and they occur mostly in two zones on either side of the equator, which corresponds exactly with the sun spot zones in position. It is also in these sun spot regions that the terrific storms of the sun's atmosphere are mostly confined. So with respect to atmospheric disturbance there is a notable resemblance between the sun and the earth, which ought to be expected in view of the physical theory.

By continually observing the sun's disk during the last 50 years Astronomers have noticed that sun spots and storms are subject to a periodic increase and decrease covering from 10 to 12 years. For 5 or 6 years there is a gradual increase in number and size, then they decrease until there are very few; the time from one point of highest number to another being between 10 and 12 years. It has also been noticed that the earth's magnetic equilibrium is disturbed at the time of greatest solar activity and spottiness. And further, it is found that the wind storms of the earth appear to increase somewhat at the same time. So far as known to me there is not enough reliable information on this subject to base a safe conclusion. From what I have learned so far the idea was suggested that if this periodicity really exists in such an extensive number of phenomena in both the earth and the sun, and if there is a close correspondence in time between the two, that the explanation might be found in the regular movements of some outside body or bodies, which can sensibly effect the sun's atmosphere thru radiation.

Now the planet Jupiter is the largest in our system outside the sun, his volume exceeding all the other planets put together. The present temperature of Jupiter is believed to be greater than that of any of the other planets. His period of revolution around the sun is 11 7-8 years, which agrees very close with the periodic time of the sun spot cycle. His average distance from the sun is 492 millions of miles, and this distance varies within 24 millions of miles between the two opposite points in his orbit, perihelion and aphelion, being nearest to the sun in perihelion. Hence it seems that Jupiter more than any other single body in our system ought to possess the power of causing disturbance in the sun, and thru the sun, of acting upon the earth. It is also evident that this influence of Jupiter might be increased or retarded by the other planets both in amount and time. The conjunction or opposition of the earth or of any other planet, one at a time or two or more, with Jupiter, might increase his action or interfere with its regular occurrence so far as to bring it on a year in advance, or retard its time of arrival. On the other hand, if any planet within the orbit of Jupiter, one or more, should happen to occupy the point in its orbit situated at 90 degrees from the sun, with reference to the position of Jupiter, that planet would have a retarding effect on Jupiter. The facts thus far known to me which seem to bear on this matter are briefly as follows.

Dr Wolf of Zurich, has prepared from the recorded observations of others, a list of the relative number of sun spots for each year since 1750. This list shows 11 complete cycles from 1750 to 1870, giving an average as near as possible of 11 years to each cycle. But in the account of this record there is no mention of the time of the perihelion passage of Jupiter—whether it corresponds to the time of greatest solar activity or not, or anything about it. From other sources I have learned that 1858, 59, 60 and 61, were years of many sun spots. Jupiter was at his perihelion point in December 1856, about one year prior to the beginning of this sun spot epoch. Jupiter's next perihelion arrival occurred in October 1868. In this year a severe earthquake occurred in California and the usual sun spot activity followed in the few succeeding years. The next perihelion of Jupiter came in September 1880. The following years, 81, 82 and 83, were years of many sun spots, storms and floods. In July 1892 Jupiter reached perihelion again and on April 19th of the same year California had another severe shakeup, more severe than any since 1868. Jupiter's next perihelion occurred some time in 1904. The severest earthquake of all, so far, which almost completely destroyed San Francisco, in California, occurred some time in April of that year. The year 1902 will be remembered as the most disastrous in modern times in the history of volcanoes. It was also an unusual year for storms and floods in the U. S.

This is all I can mention at present (June 1908) and some of these statements may not be strictly true. But on the whole they seem to indicate the possibility of the presence of a mechanical agent which, tho not perfectly regular, perhaps owing to the several conflicting elements, seems to at least tend to keep the sun spots, sun storms, earth storms, earthquakes, volcanoes, aurora displays and magnetic disturbances on the earth, pretty well together; tho they do not coincide quite so well with the perihelion passage of the planet Jupiter. But this should be expected, to some extent at least when we consider the conflicting agents. Very likely observers in the future may be able to settle the question as to how far this planet is concerned, and what are the nature and amount of the influences from other sources, and whether they are altogether mechanical.

It is to be expected from this general theory that an earthquake or a volcanic eruption may be induced by the same cause which permits the expansion of the atmosphere of the sun or the earth, or the elevation of the surface of the ocean as in the tides. The pent up expansive energy within the surface of the earth due to heat, is perhaps greater at some points than at others, and any decrease of outside pressure on the general surface must tend to give this energy greater liberty, hence the eruption at old vents or the shaking of the surface.

The opinion has been advanced that comets, in some mysterious way may be able to produce the effect which gives rise to sun spots. When the large comet of 1883 made its short turn around and close to the sun a large spot broke out suddenly on the part of the sun's disk nearest the comet, and the same thing happened with the great comet of 1843. The presence of the comet would relieve the outside pressure of the medium, thus permitting the expansion and thinning of the sun's photosphere, hence its displacement and the intrusion of the medium forming the spot. This would also involve the electric repulsion fully explained in §26.

As to the magnetic or mechanical influence of the sun upon the earth, it seems that we have the most satisfactory evidence. It is well known that currents of electricity are induced and kept going around the earth by the sun, which heats successive parts of the earth's surface as it turns on its axis. These currents being currents of expanded ether similar to those in a magnet or a conducting wire (Chap. V.), the needle of the compass is made to point north and south in order to bring its revolving currents into harmony with the earth currents; that is, the direction of the current in the under side ofthe needle must be the same as those of the earth in order to prevent friction and to maintain the currents in the magnet. A further application of the same theory will explain the daily oscillations of the needle, the slight changes in the daily movements during the year, the changes of the position of the earth's magnetic pole, and other mysteries of terrestrial magnetism. These things are here only briefly noticed. A thorough experimental research will be necessary to make everything clear, and this is beyond my reach at present.

The so-called magnetic storms which produce sudden irregular movements of the needle, and which are known to effect not only all other needles throughout the world at the same moment, but in many cases the telegraph instruments and the electric condition of the atmosphere are known to be most intimately connected with unusual disturbances in the sun. It has been often noticed that when the earth's magnetic equilibrium is disturbed in this way, there is an unusual display of the aurora lights in the polar regions of the earth's atmosphere. Explorers in the Arctics have noticed that the aurora was never visible over ice fields, that when in progress the luminous streamers always appeared over the open sea. It is well known that water is a better conductor of electricity than ice. Many persons have noticed the close similarity of the aurora lights to certain forms of electric discharge. Mr. R. A. Proctor, the astronomer, says: "As to the electric character of these displays, no question can be entertained although there are few problems of greater difficulty than the determination of the exact manner in which the electric action is excited." No doubt of it, electricity is the active agent, and when we come to understand what electricity is (Chap. V), the whole will come under the laws of inertia, and the difficulty is gone.

It is known that the earth's magnetic condition, or power to maintain the needle in position, varies during the year, being greater during the two months December and January, in both hemispheres. The earth makes his perihelion passage about the first of January, at which time there is the least distance between the earth and the sun, the distance at this point being about three million miles less than at aphelion. From which it is supposed that the sun's magnetic influence varies with the distance, being greater when the distance is least. Observation even goes so far as to make it highly probable that this influence varies as the square of the distance, which, if true, would be in perfect harmony with our mechanical theory of gravity (§ 20). It is also known that the moon affects the magnetic condition of the earth. By means of the horizontal pendulum it has been found that bodies at the surface of the earth directly under the moon, have slightly less weight than elsewhere.

Here we have a community of carefully observed and established facts, all showing an intimate connection with one another and with periods of unusual activity in the sun, and all of which speak out plainly for a common cause; and what can it be if not the mechanical action of a material medium like the ether?

26. Comets.—Perhaps there is no object in the heavens better fitted to attract attention or excite the speculative mind than the comets of our solar system. When seen on a dark, clear night, with that wonderful appendage called a tail stretching across the heavens for over a hundred million miles, the imagination of the superstitious man begins to see world-wide calamity; and his prophetic vision often impels him to warn the world of the impending wrath of an offended God. But the man with a more rational turn of mind takes a different view of the matter. With him it is a problem which makes a strong appeal to man for an explanation. The feature which is best calculated to attract the attention of the thinking man, is the strange behavior of the comet while making its perihelion passage around and close to the sun. It is known that a comet while passing this point in its orbit may come very close to the sun. The comet of 1843, the largest of the century, actually rushed thru the outer limits of the sun's atmosphere, so close that the heat was estimated to be 2000 times greater than red hot iron.

While in the midst of this fiery gauntlet the tail of this comet began to develop with surprising rapidity, reaching a length of 120 millions of miles in a few hours. And most remarkable, this tail presented all the appearance of being repelled or driven outwards by some repulsive action of the sun. To convey a correct idea of this phenomenon and of the difficulties attending it, I must quote a passage from the writings of Sir John Herschel, who was one of the most competent and careful of observers.— "It is clear that if we have to deal here with matter such as we conceive it, viz, possessing inertia at all, it must be under the dominion of forces incomparably more energetic than gravity, and quite of a different nature." In another place the same writer presents the difficulties of the case in the following passage.—

"There is beyond question some profound secret and mystery of nature concerned in the phenomenon of their tails. Perhaps it is not too much to hope that future observation, borrowing every aid from rational speculation, grounded on the progress of physical science generally, especially those branches of it which relate to the ethereal or imponderable elements, may ere long enable us to penetrate this mystery and to declare whether it is really matter in the ordinary acceptance of the term, which is projected from their heads with such extravagant velocity, and if not impelled at least directed with a reference to the sun at its point of avoidance. In no respect is this question as to the materiality of the tail, more forcibly pressed upon us for consideration than in that of the enormous sweep which it makes around the sun in perihelio, in the manner of a straight and rigid rod, in defiance of the law of gravity, nay even of the received laws of motion, extending as we have seen in the comet of 1680 and 1843 from near the sun's surface to the earth's orbit, yet whirling around unbroken in the latter case thru an angle of 180 degrees in little more than two hours. It seems utterly incredible that in such a case it is one and the same object which is thus brandished."

The above is from a competent observer and I would invite the reader's attention to that part of it which refers to the apparent repulsive action of the sun, also that part which propounds the question as to whether it is matter in the then accepted sense, which is projected from the comet's head and which makes a mighty sweep of the heavens in so little time. When Herschel wrote the above the ether was not generally regarded as ordinary matter, and in fact by many it is not so regarded now. As will appear later it is to electricity that we must look for the explanation of these nature freaks. From the above it seems that the writer was looking in the only promising direction for the explanation. A study of electric phenomena in view of the ether and mechanical laws may lead us to the true solution. From all accounts it is not generally true that the tails of comets are projected directly out from the sun as described above. They are often curved backward from the direction of their motion, as tho being impelled against a resisting medium. The rapid and extensive swing of the tail of the comet of 1843, and the fact that it was projected straight out from the sun, might have been almost wholly an electric display similar to the aurora lights in the polar regions of our atmosphere but far more energetic. Perhaps the atmosphere of the comet was soon dissipated into the outer medium and that which followed was a powerful discharge of motion thru the ether somewhat like a flash of lightning but more continuous. It is known that the majority of comets appear to have tails composed of ponderable matter, most likely in the gaseous form, and that incandescent gases are good conductors of opposite electricity. The following account of comets generally is the best that I am able to offer from recent books which have come in my way.

The orbits of comets generally have the form of a greatly elongated ellipse. They first emerge from the outer regions of the solar system or beyond, and look like small roundish nebulous bodies, slightly more condensed in the center. This central part (called the nucleus) is generally brighter than the surrounding portion and it is common to all comets. Around this is a nebulous haze or atmosphere of considerable extent, growing more rare as its distance from the center is increased, called the coma. As the comet approaches the sun its coma assumes an elongated form with its longest diameter pointing toward the sun. This, according to the mechanical theory, would be a result of the sun's radiation as in the case of the tides of our ocean and atmosphere. Later on this lengthening of the coma grows more apparent and the nucleus appears to occupy the end nearest the sun and to increase in brightness. As the comet comes nearer to the sun the coma in many cases begins to undergo remarkable changes. It first appears to be retarded in its path as if being impelled against an inert resisting medium; or perhaps the momentum of the nucleus being greater, owing to its greater mass, is less retarded by the medium than the lighter material of the coma, or perhaps it is due to some extent to greater outside pressure on the more dense material of the nucleus. Next the nucleus begins to increase in brightness as if from internal disturbance and soon begins to throw out a luminous jet toward the sun. Sometimes more than one such eruption occurs but always on the side next the sun. These jets seem to arise from some internal eruptive agency perhaps not wholly unlike the volcanoes of the earth, and the materials being first projected toward the sun for a short distance are then born back by the retarding medium to form the tail of the comet which now begins to develop behind the nucleus, growing longer as the comet nears the sun and always pointing away from the sun. Sometimes the luminous matter in front of the nucleus forms into a number of crescent shaped bands one outside the other and having dark spaces between them. This feature was conspicuous in Donati's comet which had seven such envelops. The comet of 1843 while approaching the sun seemed to move almost in a straight line toward that luminary, then after swinging around and close to the sun it took nearly an opposite course returning to outer darkness. While moving toward the sun the tail projected to the rear and away from the sun, but on making its short turn around and close to that white hot mass its tail shot out at great length and always directly from the sun, so that the comet retreated to outer space with its tail in advance. Thus it would seem that this comet, head and tail, was actually blown away by some powerful action of the sun, and to some extent the same is true of all comets.

Now in view of our mechanical theory it seems highly probable that comets, the one just mentioned at least, are first impelled toward the sun by the outside pressure of the ether, as in the case of gravity or electric attraction, (the comet being negative to the sun) then on reaching that part of its orbit which brings it nearest the sun, it receives an electro-positive charge from the sun; then it is repelled and driven back to the colder region of outer space where it has a chance to cool off a little, when it is ready to be attracted again by the sun. This mechanical process reminds us of the convection currents of air in a room being heated by a stove; or of the boiling water in a kettle. The lighter material of the comet's atmosphere would first become electro-positive by a transfer of motion from the sun, and so would be repelled to form the tail which begins to develop before the comet makes its perihelion passage. The nucleus of the comet being more dense is retained longer by outside pressure. In the same way it is supposed that our moon was deprived of an atmosphere. A certain period of balance between the centrifugal force of the comet and the repulsve force of the sun on the one side, and the outside pressure of the medium on the other, would enable the comet to describe a part of a circle in which its velocity would be somewhat increased; and the repulsive force of the sun being most likely increased at the same time, a point would be reached at which the comet would begin to recede from the sun.

It is known that a flame or any heated ponderable body is always a good conductor of electricity or expanded ether, while pure ether as in a vacuum, is a most perfect nonconductor of the same. Hence it is to be expected that when the comet arrives close to the sun, its coma and nucleus would serve as an outlet for the sun's powerful expansive or electric energy, because they are negative conductors. The coma of the comet would receive the first discharge from the sun because it is outside and in advance, and being thus rendered positive would be repelled and driven back to form the tail. The eruption witnessed in Donati's comet is not perfectly clear unless it is due to some diminution of outside pressure and liberation of pent up expansive force in the nucleus. The difference between positive and negative electricity will be explained in the next chapter.

If electricity or the mechanics of the ether is the real agent in cometary phenomena it ought to be possible to give an illustration of this strange behavior of the comet by a simple electric experiment on a small scale. When this idea first occurred to me (in 1880) my first attempt seemed to be a complete success and I must describe it here. I suspended a small pith ball by a fine silk thread six inches long and attached to the ball a few shreds of cotton two inches long. Fine silk thread is a non-conductor of electricity and cotton thread is a good conductor of the same. Next I electrified an argand lamp chimney near its upper end by friction and stood it on the table top end up. I had anticipated that the electrified end of the glass chimney would serve as a diminutive sun, while the cotton tailed pith ball might play the part of a comet. When all was ready I brought the comet near the sun and noticed that it promptly moved toward the sun; (elctric attraction, gravity or difference of pressure in the ether medium). As soon as it touched the sun its tail immediately swung out from the sun and it bounded back tail first; (electric and molecular repulsion). Then being charged with electricity or expanded ether from the sun the comet was repelled, and when brought close or made to swing around the sun, its tail always pointed away from the sun exactly like a real comet while making its perihelion passage. In later experiments I adopted a small leaden ball for the comet's head; then I could make it describe a true ellipse with the sun in one foci and the tail swinging outward as with comets generally. With suitable apparatus it seems possible that every feature of comets may be duplicated by the use of electricity.

The comet discovered by Biela in 1826 on its return in 1846 was found to be divided into two smaller comets traveling side by side about 200,000 miles apart. The same two comets appeared again in 1852 moving somewhat further apart. In this fact we have an example on a large scale of the electro-molecular-mechanical repulsive force described in the next two chapters. The comet when close to the sun would acquire the positive electricity which would make its parts self-repulsive, hence the division. Writers on the subject generally admit the presence of this repulsive force. Bessel proposed a form of magnetic polarity and repulsion but did not explain magnetic polarity or repulsion. Prof. Loomis in his treatise on astronomy says.—"In order to explain the phenomena of comet's tails it seems necessary to admit the existence of a repulsive force by which certain particles of a comet are driven off from the nucleus, and that these particles are then acted upon by a more powerful repulsive force eminating from the sun." R.A. Proctor, in the 'Contemporary Review,' says concerning the electric nature of cometary phenomena. "It is worthy of note that outside of electricity there is nothing known to physicists which seems to offer even a promise of explanation, so far at least, as the grander and more striking, also the more mysterious of cometary phenomena." Dr Huggins the spectroscopist, who examined the spectrum or self-light of comets, entertained similar views. In short, from the testimony of many careful observers, well fixed for the work, it seems plain enough that a complete solution of the mystery about comets is a complete solution of the mystery about electricity, showing that the laws of electric action are laws of motion. The question whether the sun is electrified positive or negative is, according to our view, simply a question of electric intensity or degree of ether expansion, the sun's ether being more highly expanded than that of the comet and therefore positive to it. Or, in other words, the ether in the sun contains more motion, volume for volume, than that in the comet, so contains more expansive energy or power to move bodily in any direction of least resistance, and a direction of least resistance is toward and thru the comet, because its electricity or expanded ether is negative or less intense. But when the projected substance of the comet's head receives a charge of positive ether from the sun it is then repelled, because like electricities always repel each other; a fact to be explained later.

It was mentioned in §25 that comets may have the power of causing sun spots, and this is to be expected and may be readily understood from the mechanical point of view. The hot atmosphere of the sun repels the atmosphere of the comet as soon as it becomes positive, then it is driven back to form a tail. The comet also repels the atmosphere of the sun, but the sun being so much larger than the comet, its atmosphere is only displaced or driven outwards from a point directly under the comet; so the interior and darker body of the sun is exposed to view as in the spot. When we come to understand the electro-mechanical theory, the phenomena of comets will be better understood, and this is our object in the next chapter.

CHAPTER FIFTH.

MYSTERIES OF PHYSICS.

27. SENSIBLE AND INSENSIBLE FORMS OF MOTION.— This chapter is occupied for the most part with the mysteries of electricity and magnetism, the facts of which, being generally treated under Physics. As in the preceding chapter the object here is to derive the harmony of the facts from the laws of motion. To this end it will be necessary first to briefly notice certain sensible and insensible forms of motion.

From atom to atom the transfer of motion is insensible in time and space, but between bodies of sensible mass it requires a sensible time. It is here inferred that the transfer of motion among the ultimate particles of matter is exactly the same as it is among sensible bodies. There is only one way according to this theory, (§I9). A bullet thrown against a pane of glass will break it into a number of pieces, but the same bullet if fired from a rifle will cut a round hole in the glass not much larger than the bullet. The lesser velocity has time to impart motion to a larger volume of the glass, while the greater velocity effects the separation of a small portion of the glass from its other parts before the motion has time to communicate itself to the other parts. This experiment illustrates the general truth that the communication of motion, even among the smallest particles, requires time, and the fact is unexplained until we admit that there is empty space between the smallest particles and that all their movements may come under the laws of inertia. It is also this fact, in the case of the rifle bullet, which increases the penetrating power of a cannon shot nearly four fold when its velocity is doubled. The energy of a given mass, therefore, increases as the quantity of its motion, not as the square of its velocity, as mentioned in text books.

If we shoot a billiard ball straight across the table it will rebound straight back again. If it strikes the opposite side from an oblique direction it will rebound in an opposite oblique direction, both directions always forming the same angle with the perpendicular. In every case of visible motion, that of composition or subdivision, that which appears as circular, elliptical or that of any curve, accelerated or retarded motion, the movements of the gyroscope or spinning top, cases of interference, pressure or impact, all should come under the mechanical laws which we derive from the inertia of matter.

All wave motion, according to this theory, ought to be the same in form, whether sensible or insensible. Perhaps physical scientists will object to this proposition because it is not in the books, but books may not be always right. The visible waves on the surface of water do not convey a complete idea of all that's in wave motion. The true form of all wave motion, as required by inertia, is that of alternate condensed and expanded spheres propagated thru the medium in all directions. In the condensed part of the wave the particles of the medium are forced closer together but they immediately reexpand to a point beyond the normal density and so form the expanded part. The result is a transfer of the motion to another part of the medium in advance and so the motion proceeds outward while the matter remains behind. In the reexpansion of the condensed part of a wave that part of the medium directly in front of it is pushed forward to some extent while being condensed, hence a part of the medium oscillates to and fro in the direction of the wave motion. In the condensed part of the wave the particles are forced closer together thus shortening their range and increasing their velocity and energy of impact upon one another, hence for a brief period there is an accumulation of energy in the condensed part of the wave. In the reaction which follows this potential energy is continually being transferred thru the medium as long as it retains the wave form of motion, being gradually reduced according to the law of diminution. (§20).

This form of ether wave comes directly from the physical laws described in (§16). From these laws it seems that we can distinguish three forms of motion in the ether, that of its individual particles, that of its waves and that of its currents. The current form will be described when we come to deal with electricity; the wave form was described above; that of its individual particles should have some attention here. As already assumed (§19), the ether medium is composed of exceedingly small, perfectly solid and elastic particles of inert matter, totally incapable of internal relative motion because they are absolutely solid. Individually such particles can have but two forms of motion, the whirling motion and that of a straight line thru empty space. In the first there is little or no effect beyond the limits of the particle itself. In or from the latter great results immediately follow. Each particle is governed entirely by its own inertia, that is, it will move in a straight line until it strikes another particle then it will bound off in a different direction and so on continually vibrating between the others which happen in its way. This motion may be more or less and the quantity of motion in the medium at any point will determine its density at that point. It is not difficult to see all the mechanical possibilities for such a medium. It will exert enormous pressure in all directions, and for this reason it must be bounded on all sides by matter which will resist its outward pressure, (§51). When expanded at one point more than at others it will move in any direction of least resistance, hence the current. An elastic medium of this sort may serve as a perfect vehicle for wave motion, since it is capable of yielding to more or less condensation from which it will promptly react. This form of wave appears to be the only one that will harmonize with this form of medium, which in itself is the only material medium justified by the laws of inertia and relativity. From which it follows that all wave motion should be the same in form, whether of light, heat, electricity, sound or waves in liquids.

In the course of this chapter it will appear that all the different forms of electricity and magnetism may be derived from this form of the ether medium with ponderable matter and physical laws. Also in chapter 6 it will be shown that even the complex facts of chemistry may be reduced to order under it.

The laws of the reflection of motion, which govern the motion of ordinary projectiles, (p,133), are equally true of light waves, heat waves, electric waves and sound waves. Dense bodies, the metals, are the best reflectors of wave motion, and this is due not only to smoothness of surface but to superior inertia. There is more matter in the dense body and proportionally more resistance offered to motion. Waves of the same length, either in light, heat, electricity, sound or those of liquids, when they meet from opposite directions, will interfere and destroy each other; that is, they blend together and the wave form is confused and obliterated, and the motion is changed into other forms, perhaps that of electricity in the case of ether waves, and that of heat in the case of sound or fluid undulations. This is an important fact which has something to do with our theory of electric repulsion described in this chapter.

The intensity of all wave motion decreases as the square of the distance thru which it travels increases. This general law of the communication of motion from a single body or point to the surrounding medium in all directions, illustrates the truth of the universal presence of inertia, which requires that motion must decrease in intensity as the quantity of matter to which it is imparted is increased.

All wave motion may be refracted, focused or dispersed. When light, for example, is passing from any medium, into a more dense medium, from a direction oblique to the surface of the denser body, it is refracted or deflected from a straight line. This bending from a right line is generally but not always toward the perpendicular. When the light falls from a direction perpendicular to the surface of the denser body, there is no refraction. In all cases of refraction a part of the wave motion is reflected from the surface. It seems that refraction itself is a form of reflection due to the inertia of the denser body. In thus passing from a rare into a dense medium, light is also retarded in its velocity, and the difference of velocity in the two media bears a constant ratio to the index of refraction. There is also some correspondence between the density of a body and its refracting index, hence it is to be supposed that the retardation of velocity is due to the fact that the wave motion is communicated to a greater quantity of matter in the more dense part of its medium. If this is true it would then seem highly probable that the ponderable part of transparent bodies must serve as a part of the medium of light, and contrary to the view now held light is not confined to the ether alone. On this subject Professor John Tyndall, in his notes on "Light and Electricity," says. "The density of the ether is greater in liquids and solids than in gases, and greater in gases than in vacu. A compressing force seems to be exerted upon the ether by the molecules of these bodies." This is perhaps only a conjecture from the fact that light is retarded in its passage thru ponderable bodies in proportion to their density. But it is not justified by this general theory, which requires the ether to be more expanded as it approaches or mingles with the molecules from which it gets its motion, and that it must be less dense as the density of ponderable matter is increased. Hence from this theory it is most likely that transparent ponderable bodies form at least a part of the medium of light, tho some of the light must be intercepted.

When waves of sound strike a nonconductor of sound they are reflected more or less, but those which pass the sides of the body will travel around the side to the side opposite. When waves of light strike an opaque body they are partly absorbed and partly reflected, but those which pass the sides of the body do not pass around it like the waves of sound, hence the body casts a shadow. This difference between light and sound seems to be a result of the great difference in their velocities. Light travels at the rate of 186,000 miles per second and sound travels at the rate of 13 miles per minute, hence the sound has time to communicate itself in a lateral direction while the light has not. It is a case similar to that of the bullet when thrown against a pane of glass and when fired at the glass from a rifle.

Other seeming discrepancies between modern scientific teaching and this general mechanical theory, might be mentioned. But this work being a general theory necessarilly more or less incomplete at first, and being more concerned with general principles, must be expected to overlook the small details to some extent, which small fry may wait for future notice. What we should notice here is the fact that our common sense ideas about sensible things may guide us to the truth about insensible things.

28. **Electricity.**— In this, and in the following sections, I will undertake to explain and reduce to order the best known facts of electricity and magnetism, as would be required by this general theory. The task is a difficult one but from all that has gone before, the outlook for something important on the same line is highly favorable.

The several forms of electricity are known as frictional, voltaic, thermal, atmospheric, animal, electro-magnetism, magneto-electricity, terrestrial magnetism and ordinary magnetism. All these are changeable into each other and into light, heat, sound, chemical action and sensible motion, and so far as known they conform strictly to the law of quantity; that is, any one form will give rise to only its equivalent of some other form. It is now generally believed that all of these, whether electric or magnetic, are forms of electricity and that electricity is a manifestation of the one universal but as yet mysterious energy. This should be remembered in view of our theory that physical energy is nothing but the motion of inert matter, and that the laws of its transformation and conservation are the laws of motion which we have derived from the same inertia. (§16).

The well known facts of electric attraction and repulsion were noticed and recorded by the Greeks 25 hundred years ago. But no experimental work for more knowledge was commenced until about the beginning of the 16th century. From that time to the present, particularly in the last 50 years, electric science has advanced rapidly and many able investigators have made fame and fortune in this field of research. It was first supposed that only a certain class of bodies called electrics, such as glass, amber, guttapercha, sealingwax, silk and flannel, were capable of producing electricity by friction. But later experiments revealed the fact that all the electrics were nonconductors, and that bodies on which no electricity could be developed by friction, such as the metals and the like, were conductors. This important discovery was soon followed by another, equally important and showing that when conductors are properly insulated, they too were capable of electric excitement by friction, and so it was finally established as a general truth that under proper conditions electricity may be developed by friction on all bodies. This is another fact to be remembered in view of the mechanical theory. The discovery of facts soon led to the devising of theories to account for the facts, and so many ingenious theories have been proposed; but so far all of them have proved unsatisfactory to scientists generally. An account of all these theories would be unnecessary here as they may be found in the books and it will be noticed that all of them include the idea of an unexplained attractive and repulsive force which resides either in the molecules, or in the units of an hypothetical electric fluid or two fluids, and which force remains entirely outside the sphere of mechanical law. The need of a true theory of electricity is now well understood by scientists and of course the true theory must take in all the universe.

It is well known that electricity exists everywhere in nature in some disguised form which shows no sign of its presence unless called into activity by friction, heat, chemical action or magnetic influence. It is also known that the ether exists everywhere in nature except in the space occupied by the atoms. Electricity is found at all times in the insensibly small pores of all solids, in liquids and gases, and in the atmosphere, and it appears to increase in strength and quantity with the altitude. This is also true of the ether. There is nothing in all this to interfere with the idea that the forms of electricity and magnetism, are forms of ordinary motion, changeable into each other and into other form, as light, heat, sound and sensible motion, and that the substance which moves is the ether in its close relationship with the molecules of ponderable bodies. These molecules are always immersed in the ether, they move thru it and the idea that they must impart some of their motion to this medium, is certainly one of the true ideas which must have a place in our system. The belief is now very general among scientists that the ether will play an important part in some future theory of electricity, but so far it seems that no precise line of investigation, under physical law, has been pursued to this end. Let us bear in mind that the primary assumption in this general mechanical theory is, that all physical activities or so called forms of energy, as light, heat, electricity, magnetism, chemical changes, the X rays, sound, gravity and all sensible movements, are nothing but forms of motion in the one substance, the inertia of which is the governing law of all.

29. Frictional Electricity.— If the ether is a medium composed of small particles of inert matter as described, there can be no doubt but that it may receive motion from ponderable matter. Science has already admitted this as necessary in the case of the wave theory of light and heat. Since it receives motion in the form of waves, there is no difficulty in the idea that sensible portions of its body may receive the motion of expansion exactly the same as does pondeable gases and liquids. For example, the air readily receives waves from a sounding body, and with equal readiness it may be expanded by heat or even by sound waves. By suitable means the air may be expanded on one side of a body, causing difference of pressure and sensible motion in the body as in a case of so called attraction. (§20 §32).

We may then expect the ether to be capable of receiving the motion of expansion which is simply an increase in the velocity of its particles as described in (§27). In the case of sound the motion is converted into sound waves by the impact of a moving body against a resisting surface which surface yields to some extent but immediately reacts and starts the sound wave. In the case of heat a body may be heated by impact or friction or by its contact with another heated body, in which latter case the motion is supposed to be communicated directly from molecule to molecule. It is a familiar fact that sensible bodies may be heated in this way and that the heat may be directly communicated to the surrounding air. Heat being molecular motion both in solids and in gases, and the molecules being immersed in the ether, it is impossible to escape the idea that some of this motion is imparted directly to the particles of the ether. Hence the expansion of the ether is inevitable. In the case of light, the heat of impact or friction has only to be increased to the point of incandescence or white heat, then the body emits the very short, quick waves which give rise to our sense of light. Scientists now distinguish a number of different wave lengths among these. The shortest, forming the visible spectrum, are called light, and the longest, being invisible, are heat waves. Science also recognizes two forms of heat, the wave heat and ordinary heat, which latter is supposed to be a confused motion of the individual molecules and atoms, which of course must be governed by the laws of inertia. The former is that found in the invisible part of the spectrum and which travels a long distance with the velocity of light. The latter does not travel so far but is more potent in expanding the atmosphere and other gases and liquids near its source. Electric waves and x waves are now also recognized by the cultivators of science.

Now there is no reason why we should not distinguish and recognize two forms of motion in the ether, similar to the two just mentioned in ponderable matter—wave motion and the confused vibratory motion of the particles like that of ordinary heat. The first mentioned would be light, wave heat and electric waves, and the latter would be frictional electricity or the motion of the particles which results in the expansion of a sensible body of the ether. This idea comes directly from the ultimate particle of inert matter, governed as described in §27.

This expanded body of ether may be expected to exert pressure outward in all directions against the surrounding more dense ether, exactly as does a body of expanded air. The draft of a stove depends on the fact that the air in the flue has been expanded by heat and so being made lighter, volume for volume, is pushed up the flue because the outside more dense and heavier air is allowed to flow into the stove. To account for this fact we must admit that the expanded air exerts pressure outward against the surrounding more dense air. So with the ether.

Now this expanded body of ether may cause difference of pressure resulting in the motion of sensible bodies, the same as does the expanded air in cases mentioned in §20. But in this case we would call it electric attraction. This expanded body of the ether may also move in any direction of least resistance as does the currents of hot air up the chimney. Remove the cork from a bottle containing expanded air and we have an example of this motion which will apply to illustrate certain forms of electric discharge. The expanded air rushes out of the bottle until equilibrium is restored in the ponderable part of the medium. In like manner the ether rushes out of the expanded field until equilibrium is restored as in a flash of lightning and in other cases. In this we have the source of the electro-motive force in all cases of current not purely undulatory, as well as in cases of discharge. But the phenomena of conductivity and resistance are complicated with certain molecular facts which we must trace out in order to understand the whole, and this is to be attempted in the following sections.

Since all space except that between the smallest particles of matter should be occupied, it follows that, as the density and quantity of ponderable matter in the earth's atmosphere and solid surface increases downward from the outer limits of the atmosphere, the density and quantity of the ether should decrease in the same direction. The ether should also be more expanded by the molecules which move in it, in particular the more dense or those containing the most molecular motion. It is known that the earth's solid surface is a good absorber and conductor of heat, also a good absorber and conductor of electricity. The metals are all good absorbers and conductors of heat, and almost exactly to the same extent they are absorbers and conductors of electricity. The conducting capacity of a number of the metals for both heat and electricity, has been carefully examined by four investigators, Weideman, Franz, Riess and Lenz, with results as follows.—Silver, for heat, 100; for electricity, 100. Copper, for heat, 73; for electricity, 66 to 73. Gold, for heat, 53; for electricity, 53 to 59. Brass, for heat, 23; for electricity, 18 to 21. Tin, for heat, 14; for electricity, 10 to 22. Iron, for heat, 11; for electricity, 12 to 13. Lead, for heat, 8; for electricity, 7 to 10. Platinum, for heat, 6; for electricity, 10. Bismuth, for heat, 1; for electricity, nine-tenths of one.

It will be seen that these results afford substantial support for the mechanical theory. It is to be expected that where there is the greatest capacity for receiving molecular motion there we ought to find the most of it, and there the ether would be most apt to receive motion from the molecules. On the other hand, it is known that all light, porous bodies, as dry air, silk, flannel, glass, sealing-wax, guta-percha, dry wood and the like, are bad conductors of both heat and electricity, a further notable confirmation of this theory, because we ought to expect that bodies in which there is little capacity for receiving or imparting such motion, there the ether ought to be more dense, thus making such bodies a direction of greater resistance to the electricity or expanded ether and therefore bad conductors. So it would seem that the difference in conducting capacity in different bodies, is purely a physical difference; that is, a form and size of the molecules which makes them more or less capable of receiving and communicating motion to each other and to the ether. Now from our well known mechanical laws it may be readily seen that in this relation of ponderable and imponderable matter, there will always exist a tendency toward universal equilibrium, and that any disturbance of this tendency, as in a sudden or unusual expansion of the ether at any point, may give rise either to a sudden discharge or a moderate current of electricity in any direction of least resistance, thus resulting in a move toward equilibrium. Since the ether in nonconductors should be more dense than in conductors, the direction of least resistance in a case of frictional electricity near the surface of the earth, ought to be toward the earth, toward a conductor or thru a conductor, in particular if it makes connection with the earth. As an example, if a glass rod held in the hand be electrified by friction, the expanded ether immediately on the surface and within the pores of the glass, cannot flow into the earth because the glass is a bad conductor; and the glass is a bad conductor because the ether within and on its unelectrified parts is more dense than that of the expanded field; and the expanded field or body of electricity cannot escape into the earth because it is more or less completely fenced in by the surrounding more dense ether. The rarefied ether thus corraled, clings to the glass for a short time because the glass is a ponderable solid in which the ether is somewhat less dense than in the surrounding air, hence it is held there by outside pressure until dissipated just as heat is. The same thing happens with an insulated conductor when excited by friction. But if a conductor which connects with the earth be subject to friction, the ether is expanded the same but it is immediately dissipated into the earth and the general equilibrium between the earth's tension and that of the surrounding air is maintained, and so there is no appearance of electricity. In this we have the reason why electricity is not dissipated upward as is the case with expanded air by the buoyant force of the surrounding air, but must tend to cling to insulated solids or to be discharged toward the earth, or toward or thru conductors which connect with the earth. And the motive force is not only the expansion of a sensible body of ether but the outside resistance of the surrounding more dense ether as in the case of expanded air. But the comparison of the air in this case is not altogether correct because the outside pressure of the air is due to its greater density and weight, while the outside more dense ether acts only as a resisting medium. The rarefied ether most likely receives its motion direct from the molecules in the surface of the two bodies rubbed together, which molecular motion is due to friction. This view seems the most likely since different substances are known to produce different degrees of expansion in the ether.

It seems altogether impossible to conceive how motion can be changed by friction into any other form but that of the individual molecules which results in expansion, unless it be a like motion in the ether. The necessary truth that no motion is ever lost or changed into anything but a different form of motion, and the fact that friction will readily produce heat and expansion in ponderable matter, leaves no question but that this expansion of the ether is the true source of this form of electricity. Frictional electricity in its origin, and to a certain extent in its relation to conductors and nonconductors, is therefore simply a series of connected forms of motion in the ether, influenced more or less by the forms of the molecules of the bodies with which it is associated, and governed by the laws of motion which come from the inertia of matter. This however, if true, is not the whole truth since it can be easily shown that a body of expanded ether will not always flow into another body of expanded ether. This important fact is next to be noticed.

30. POSITIVE AND NEGATIVE ELECTRICITY.— The commonly accepted theory now is, that there are two kinds, or two degrees of electricity; the one called positive, or more, and the other called negative, or less. It is still claimed by a few that there are two kinds of electricity, but the majority I believe hold to the theory proposed by Dr Franklin,— that of one kind or form, appearing as positive and negative. According to this view, the act of electrification by friction, effects a division of the one electricity, one part of which clings to the rubber and the other to the body rubbed. For example, if a glass rod be rubbed by silk positive electricity will be developed on the glass and negative on the silk. These two divisions may be known by the fact that two bodies charged one positive and the other negative, will always attract each other, while two bodies charged alike, either positive or negative, will always repel each other. The words positive and negative, proposed by Dr Franklin and used as meaning more or less of one kind of electricity, are still in use and they are very appropriate for the present mechanical theory.

According to this theory the act of electrification by friction would consist in the expansion of a small body of the ether, a portion of which clings to the rubber and the rest to the body rubbed. In order to account for the difference between the two forms of electricity it seems necessary to admit that a physical difference in the molecules of the two bodies rubbed together, enables them to communicate to the ether different periods of vibration or different degrees of expansion. Thus owing to a difference in mass, number and arrangement of the component atoms in the molecule of glass and that of the silk, (upon which depends their difference in chemical properties) the act of rubbing the two bodies together, will give rise to two expanded fields in the ether, in which the particles oscillate with different velocities, thus resulting in different degrees of expansion in the two fields, the greater of which being properly called positive and the lesser negative. Two expanded fields differing in this way would not repel each other, but would be forced together, mixing and neutralizing each other, by the outside pressure of the medium, so behaving like positive and negative electricity. But two expanded fields having the same degree of expansion would repel each other or behave like the same form of electricity, either positive or negative, when imparted to two separate bodies or to one elongated insulated conductor. As already mentioned in chapter fourth, the outside pressure of the ether must be greater on the sides than on the ends or edges of a conductor having the form of a cylinder or a plate; hence two bodies which can freely separate, and when both are charged with the same form of electricity, will repel each other by the combined action of outside pressure and inside expansive force. The outside pressure acting strongest on the sides gives the expansive force a tendency to act in the direction of the length of the field thus pushing the two bodies apart. But if the two bodies are charged with opposite electricities, then there is no internal resistance and the two expanded fields will unite by outside pressure and for the reason that each offers to the other a direction of least resistance exactly as does all conductors of electricity.

This assumption of no resistance between two differently expanded fields in the ether may not be readily clear to some readers, but it seems to be the only way to a solution on physical laws, besides, it is justified by a number of well known facts. It is known that different bodies when heated to incandescence will throw the ether into waves differing in length as in the monochromatic lights; also, that different bodies emit ordinary heat in which the molecules manifest a difference of motion. Waves of like periods when meeting from opposite directions always interfere and destroy each other, but if their periods or lengths are unlike, they pass into and thru each other without interference. This is likewise true of light waves, heat waves, electric waves and sound waves, and this is a significant fact in this connection because it plainly indicates that electricity in the ether is mechanically the same as heat in ponderable matter. It may be possible to test this question experimentally, by causing two sounding bodies suspended near each other to emit sound waves of the same and of different lengths, and by observing the result.

All non-conductors when electrified by friction are at once converted into conductors of the opposite electricity. For example, a stick of sealing-wax when unelectrified is a bad conductor of both forms of electricity, but when charged by friction it promptly conducts or absorbs the electricity of glass. If we suspend two pith balls, one by a non-conducting thread and the other by a good conducting thread, the latter is always most powerfully attracted either by the glass or by the sealing-wax. The good conductor offers to the expanded field a direction of least resistance, hence outside pressure prevails and attraction results. The two electricities seem to behave toward each other very much as they do toward neutral conductors, in which, according to this theory, the ether ought to be at all times to some extent expanded. It seems highly probable that there is more than two forms of electricity, among which there is only a physical difference. The electricity of the sun would then be positive to that of the earth while that of the earth would be positive to the electricity of the moon, and the earth's electricity would then be relatively both positive and negative.

It is known that under suitable conditions the so called negative electricity may be developed on glass and the positive on sealing-wax; indeed there are many facts on record tending to show that the physical condition of bodies have a great deal to do with the form of electricity they may exhibit when rubbed. For instance, if a piece of polished and a piece of rough glass be rubbed together, the former will acquire positive and the latter negative electricity. The rough surface affords numerous points for the escape of the active ether and so it becomes negative by reduction. If two bodies alike in surface and in substance, but differing in temperature, are rubbed together, negative electricity will appear on the warm body. It can be readily shown that both heat and light will increase the conducting power of bodies, and that heat in many cases is a prompt means of dissipating a charge of electricity. The color of bodies also has some determining effect, as when black and white silk are rubbed together, the black will show negative and the white positive electricity. It is known that all black substances absorb more light than white substances, and that the light is changed into heat, and so the expanded ether is dissipated by heat.

The temperature of bodies in their relation to electricity is suggestive of a reason why heat is an agent in the dissipation of electricity. Since heat is molecular motion it follows that the ether within and close to the surface of a heated body may receive motion and more of it than it would from the same body when cold. But the electricity thus generated would be immediately converted into the molecular repulsive force (explained in chapter 6) which expands the air, (and in the case of combustion which converts the burning material into the gases which result from combustion) hence would not appear to the sense as electricity. Being thus conducted away as insensible molecular repulsive force, all heated bodies, tho great producers of electricity, show no signs of its presence.

The phenomena of electric induction as described in books of high authority, (see Tyndall's "Light and Electricity") appear or may appear, to some persons, as justifying the theory of two kinds of electricity, and hence should have some attention here. According to the received theory of two electricities, if an electrified body be placed near but not in contact with an insulated neutral conductor, the electrified body will act across the interval and will decompose the so called compound fluids, attracting the constituent unlike its own and repelling the opposite. When the electrified body is withdrawn, the two electricities thus separated will reunite as before, leaving no indications of electricity in the conductor. This separation of the two electricities by the influence of an outside body, is called electric induction. According to our mechanical theory, it is the same thing that happens with the earth and the moon in the case of the tides. (§23). When under the influence of induction the repelled electricity on the opposite side of the insulated conductor is said to be free; for if that side is connected with the earth it will immediately escape into the earth. Then on removing the inducing body the electricity opposite to it (and also opposite to that which was allowed to escape) will remain on the insulated body, diffusing itself over it and so exhibiting the presence of electricity. This is called electric decomposition by induction in the books, and by which means it is claimed that either the positive or the negative electricity may be separated from the other and made captive. If the inducing body is positive the captive electricity is negative, and vice-versa. These facts, if they are facts, would make it probable that there are two kinds of electricity and that they are not what this mechanical theory would make them. But this conclusion is not born out by my own experiments and reasoning from mechanical laws. According to the mechanical theory, if an electrified inducing body is placed close but not in contact with an unelectrified insulated conductor, as described above, also in the books, here is what happens.

The inducing body will act upon the other body exactly as the moon acts upon the earth in the case of the tides. The neutral body, like the earth, is always charged with some degree of expanded ether; which, under the influence of the inducing body will tend to accumulate on opposite sides as in the case of the tides and as due to the same cause. If the inducing body is suddenly removed, the so-called decomposed electricities will recombine and disappear. So far everything is clear and strictly mechanical. Now if the inducing body be again brought close to the other the apparent decomposition is again noticed; but this time if we connect the opposite side of the induced body with the earth by a conductor, then a portion of its expanded ether will be moved into the earth, and the resistance to the expanded field of the inducing body will be somewhat reduced on that side, hence a portion of its expanded ether will be transferred to the induced body; then, if the inducing body on the one side and the earth connection on the other be promptly removed, the body under inductive influence will be found to be charged with expanded ether, which, on being tested will be found to be negative or less intense than that of the inducing body. Thus it seems that the mechanical theory will explain the facts quite as well, if not better, than the older theory of two mysterious fluids.

Now to prove that electricity or expanded ether is actually transferred from the inducing body to the body induced, the following experiments seem to be entirely sufficient. Place a sheet of tin on a plate of glass somewhat wider than the tin and support the glass on a dry glass tumbler. Next attempt to impart a charge of electricity to the sheet of tin. It will be found that the tin will refuse to take any but a very feeble charge. But if a conductor which connects with the earth be placed under and in contact with the glass, or, better still, if the glass plate with the tin be placed on the bare table, then the tin will receive a strong charge which charge will show itself plainly if the glass is lifted from the table and held in mid air so that more dense ether is admitted on its under side, thus forcing the expanded ether up and making it more conspicuous. When the glass plate rests on the table the electricity of the tin is less conspicuous for the reason that there is greater density of ether above the glass in the air than there is below the glass in the table; hence the expanded field is forced to some extent thru the glass into the table by the greater pressure from above. But when the glass is lifted and held above the table in mid air, the density of the ether is nearly equal on both sides and the expanded field being thus completely surrounded and confined to the tin is at once made more conspicuous, as may be shown by presenting a pith ball suspended by cotton thread and observing the attraction. When thus charged the tin may be discharged by touching it with a conductor which connects with the earth. The Leyden jar often described in books affords a good example of the same phenomenon which may be explained in the same way. In order to charge the jar it is necessary to connect the inner coating of metal with the prime conductor of an electric machine and the outer coating with the earth thru a conductor. If the jar is completely insulated from the earth it will refuse to receive the charge. When the machine is being worked a continuous current of electricity will flow from the machine thru the jar and thru its earth connection to the earth. By means of a galvanometer it may be proved that this current is toward the earth, not from the earth, as required by the older theory of a compound fluid.

Here is an open and promising field for the experimentalist who can afford only the most simple means.

31. MOLECULAR ARCHITECTURE.— It was shown in §29 that the difference between conductors and nonconductors of electricity should be a physical difference; also that the molecular arrangement which would make a good conductor of electricity ought to make a good conductor of heat, and on the contrary a bad conductor of electricity should be a bad conductor of heat. Experiment readily reveals the different conducting capacities of different bodies for both electricity and heat and the likeness is just what we ought to expect from our theory. But can experiment with electricity or heat reveal any facts about internal structure or molecular arrangement?

We can at least suppose that the molecules of good conductors are not all held in rigid contact, but are to some extent in solution with the ether and hence more free to receive and communicate motion among themselves, and to the ether. For this reason the ether within such bodies should be more expanded than outside, thus making it a direction of least resistance to an outside source of electricity opposite to it. The good conductors are generally composed of the metallic elements and are heavier, volume for volume, than the nonconductors. Such bodies receive more pressure from the ether on their outsides and proportionally less within on the individual molecules or their small aggregates, hence the molecules would have more individual freedom, at least some of them. This is in substantial harmony with observed facts so far as known to me, but in the case of solids there must be a permanent contact of the molecules, at least some of them, in order to account for the stability of sensible forms. A bar of steel is a good conductor and it is also a very tenacious solid, hence its molecules should be united in some regular structure, perhaps something like the vegetable cell and with the interspaces filled with loose molecules in solution with the ether. This will perhaps be regarded as only speculative, but the facts amply justify it. All nonconductors are light porous bodies in which there should be a similar contact of molecules. But the pores in such bodies should be larger and they must be filled with the ether instead of ponderable matter. In this way the molecules being held in the close embrace of individual contact by a greater density of ether within the body, would not be able to receive and communicate motion like those of the metals. This molecular structure might vary in different bodies, thus accounting for their difference in conducting power as well as their different degrees of hardness. The physical pores being larger and being filled with the ether, and the molecules being held together by internal pressure direct from the ether, such properties as brittleness or tendency to break rather than bend might be accounted for. Such properties as malleability, fusability and non-combustability, seem to belong exclusively to the conductors, and this we ought to expect in view of the present theory. The molecules of such bodies can receive and diffuse the motion which would give them electric and self-repulsive atmospheres and liberate them as vapor. Not being able to receive and communicate molecular motion the nonconductor would not be able to receive and communicate motion to the ether, hence the ether within its pores must be more dense than in good conductors and so the body would be a bad conductor of electricity. The general fact that bad conductors are composed of the nonmetallic elements is significant. Being generally lighter their physical pores must be larger, and these being filled with the ether, it seems more than a speculation to suppose that this is the reason why they are nonconductors. Such bodies must sustain less pressure on their outside and proportionally more within on their small aggregate of molecules which form and sustain the rigid frame work of the body.

The molecules in the nonconductor being thus in contact under pressure close around them, and less susceptible of individual motion, would not be free to acquire independent self-repulsive atmospheres of expanded ether. (explained in chapter 6). Friction on the surface of such a body would necessarally impart some motion to its molecules, as that of heat, and this not being readily diffused thru the body because it is a bad conductor, nor converted into atmospheres of expanded ether surrounding free molecules and conducted away by upward currents in the air, would have to be communicated directly to the ether in the diffused form of an expanded field of sensible extent, as in the frictional electricity of glass or sealing-wax. It thus seems easy to see the molecular arrangement which would not only make a good or bad conductor of both heat and electricity, but the necessary means of developing and retaining frictional electricity. We also seem to have a glimpse of the inside of all solids.

32. Electric Attraction and Repulsion.— In the facts of attraction and repulsion, which have been known for over two thousand years, we have perhaps the best opportunities for successful experimental research, with simple and inexpensive means, that can be found in all the field of electricity. The necessary means are so common and so simple that a complete outfit, sufficient for a convincing demonstration, may be had at a cost not to exceed 10 c, or even less. A glass rod or an argand lamp chimney, a small piece of silk or flannel, a few inches of silk or cotton thread and a few small pith balls to be had from last year's dead stocks of the elder or the sun-flower, is the whole thing; and with these the most wonderful revelations of the inner nature of electricity, and of the truth of the mechanical theory, may be brought plainly to view. I will mention a few which I have repeated many times and which I am sure I did not compile from some familiar source.

If a dry glass rod, in dry cold weather, be slightly warmed and briskly rubbed with dry silk, flannel or any nonconducting material of suitable shape, the molecules of the glass will receive motion from the rubber as already described. That this motion is really in the glass is evident from the fact that the glass may be warmed by friction just as the hands may be warmed by rubbing them together. The ether which lies in contact with the surface of the glass and within its pores, will receive a part of this motion directly from the molecules of the glass as described elsewhere; and the motion thus transferred, will take the form which produces a field of expansion in the ether, that is, the confused vibratory motion of its particles will be increased. As will appear in chapter 6 there is reason to believe that the expansion of liquids and gases, at ordinary temperatures, is due to an increase in the molecular repulsive force, (electric repulsion) and hence that this form of the expansion of ponderable matter is not exactly the same as that of the ether in the case of frictional electricity.

This small field of expanded ether thus generated will be confined to the glass by the outside resistance of the surrounding more dense ether, and it will exert pressure outward in all directions, and it will gradually grow more dense as it merges into the surrounding medium. The limits of this expanded field will be the limits of its power of attraction. Now, if a small pith ball, suspended by a fine silk thread, be brought near the glass, the pressure of the largest part of the expanded field will be exerted indirectly on the outside of the ball, thru the more dense ether on that side, resulting in its motion toward the glass, exactly as in a case of falling motion or gravity, (§20 and 21) thus exhibiting the phenomenon called electric attraction.

The pith ball being a better conductor than the surrounding air, or in other words the ether in its pores being slightly more expanded than in the air, thus making it a direction of least resistance to the expanded ether of the glass, and the thread by which the ball is suspended being to some extent a conductor, then as soon as the ball comes in contact with the glass the expanded ether will rush into the ball, but being resisted in its tendency to pass thru the thread because the thread is not a good conductor, and the ball being charged by ether of the same degree of expansion as that of the glass, it will be driven outward by the inside pressure or self-repulsion of like electricities on two bodies which may freely separate; thus exhibiting the phenomenon of electric repulsion.

It may help us to understand this self-repulsion if we recall certain similar cases already mentioned. When electricity is imparted to an insulated metallic sphere it will distribute itself equally over the entire surface. When imparted to a cylinder the length of which is greater than its breadth and with rounded ends, it will accumulate at the ends. In the case of the sphere, outside pressure is equal at all points on the surface. In the case of the cylinder, the pressure is greater on the sides than on the ends, for reasons already described; hence the expansive force of the electricity is greater in the direction of the length of the expanded field. Electric repulsion may therefore result from the self-repulsion of two atmospheres of expanded ether of the same degree of expansion, which covers two bodies which may separate, and it may also to some extent result from the tendency of the current to force its way thru an imperfect conductor, in which case the repelled body would be forced out by the head of the current, which in turn is due to the momentum of the moving particles of the inert ether.

The fact that electricity always tends to escape from pointed conductors into the open air suggests at once the strong probability that the molecules of the air are singly and rapidly charged with expanded ether and immediately repelled outward, being succeeded by others, thus projecting a stream which follows the pith ball and thus aids in maintaining the repulsion. Outside pressure or resistance would keep such molecules in line and the line might reach out several inches. It is known that the vapor of water is a much better absorber of electricity than dry air. When there is much moisture in the air it is very difficult to retain the electricity even when carefuly insulated. The chemical formulae of water is OH2. In the next chapter it will appear that the compounds of oxygen and hydrogen are generally good absorbers of motion, heat or electricity. These facts have a meaning in the present connection.

The following simple experiments which any school-boy may perform with ease, wil afford a still better view of the inside mechanical nature of electric attraction and repulsion. Suspend three pith balls and numbei them 1, 2, 3. Suspend No. 1, by a fine silk thread, which thread is the best nonconductor among threads known to me. Suspend No. 2, by a coarse silk thread, which is a medium conductor. Suspend No. 3, by a coarse cotton thread, which is a good conductor. Do not forget that ball No. 1, with the fine silk thread is a bad conductor; No. 2, with the course silk, a medium conductor and No. 3, with the course cotton, a good conductor. Next rub the glass and present it to ball No. 1. The ball is attracted, but as soon as it touches the glass it jumps back and repulsion continues as long as the charge lasts. Now give the glass a good charge by brisk rubbing and present it to ball No. 2. This ball is attracted and repelled like No. 1, but notice that the attraction is more energetic, while the repulsion is less so, than with No. 1. This difference of more or less as compared to ball No. 1, is a significant fact as appears from what follows. Next give the glass a weak charge by moderate rubbing, and present it again to ball No. 2. This time the ball is attracted but not repelled. Finally give the glass either a strong or a weak charge, and present it to ball No. 3. This ball is always more powerfully attracted than either of the others, and it is never repelled, whether the charge be strong or weak.

Here is the explanation. The first ball, No. 1, suspended by the bad conductor, after being forced against the glass by outside pressure, is promptly driven back for the reason that when the current rushes into the ball, (it being a medium conductor) the current cannot escape thru the fine silk (bad conductor) hence inside pressure or expansive force prevails, because the ball is charged by the same degree of expansion of its ether, hence the repulsion. When the ball retreats a portion of the rarefied ether goes with it, so continuing the repulsion for a short time. The second ball, No. 2, with its medium conductor, is attracted and not repelled by a weak charge, because the conducting capacity of the thread is sufficient to carry the current thus permitting outside pressure to prevail, hence the attraction. With a strong charge the greater force of the outrush of the stronger current, and the incapacity of the thread to carry it, gives rise to a dominance of inside pressure, and the ball is repelled. From which it appears that as to whether attraction or repulsion is going to happen in any case, will depend on the predominance of one or the other of two opposing forces, which I have called inside and outside pressure.

And this conclusion receives a clinch in the fact that ball No. 3, with its good conducting thread, is always strongly attracted and never repelled, whether the charge be strong or weak, simply because the good conductor allows the free escape of the expansive force of the ether, thus preventing inside pressure and permitting outside pressure.

When the threads for these experiments are selected with care as to conducting capacity, it is possible to obtain results which illustrate this feature of electricity in its most hidden and mysterious details, and I know of nothing so well calculated to convey to the mind a clear understanding of the mechanical nature of the force concerned in electric phenomena. How the human mind could sleep for 20 centuries over a little thing like this is strange indeed. There are other forms of this experiment and I will mention one more. If the electrified glass is brought in contact with the medium conducting thread a short distance above the ball, so that the current will run down the thread and charge the ball, then the ball is repelled. But if the glass be first presented to the ball so that the current after entering the ball can run up the thread and escape thru a conductor to the earth, then the ball is attracted. Besides being in perfect harmony with the mechanical theory, these facts are conspicuously fatal to the theory of a mysterious electric fluid.

As already mentioned it is almost impossible to develop electricity by friction in a warm moisture ladened atmosphere. The molecules of water are good absorbers of heat, which they communicate directly to the ether as atmospheres of expansion, so enabling the molecules to repel each other, also the molecules of the air, hence the presence of the vapor of water in the atmosphere. This makes a wet atmosphere a better conductor of frictional electricity than a dry atmosphere. Electricity by friction should be positive to that of the molecules.

Our atmosphere and the various gases and liquids are all good transmitters of wave motion while they are generally bad conductors of heat. But they are readily heated by convection, which is a circulation due to expansion and difference of pressure. The expansion is a result of an increase in the molecular repulsive force due to the absorption of heat by the individual molecules, which heat is transformed into expanded ether as above described. The ether is also a perfect transmitter of wave motion as light, heat waves and electric waves, while it is perhaps the most perfect nonconductor of frictional electricity. The harmony of these facts may be readily seen from the mechanical point of view. As will appear in the next section there are convective currents in the ether similar to those of ponderable matter and due to the same cause.

33. VOLTAIC ELECTRICITY.— Electricity developed by chemical action is called voltaic or galvanic electricity. All chemical action is supposed to produce some electricity, more or less as the energy of the action is more or less. If we place a sheet of

zinc and a sheet of copper in a vessel of water to which has been added a little sulphuric acid, and connect the two metals by a copper wire outside the solution, chemical action will begin between the zinc and the acid, resulting in the decomposition of the acid and the formation of zinc-sulphate, and the hydrogen of the acid will be set free. During this action a current of positive electricity will flow from the zinc or place of action, thru the water and thru the copper strip, then thru the wire and back to the zinc. A weaker current of negative electricity may also flow in the opposite direction thru the same channel, perhaps starting from the whole length of the wire and strip, which at all times are sources of negative electricity. This negative current, according to our theory, is simply a lower degree of expansion in the ether within the pores of the metal. The metal is thus a direction of least resistance to the expansive force of the ether at the place of chemical action. Here we have very much the same form of activity, governed by the same physical laws, that we have in frictional electricity; differing mainly in the fact that the source of the motion is not friction but chemical action. It seems necessary to describe this chemical action somewhat as follows.

As will be shown in the next chapter, the molecules of the zinc and the acid have an affinity for each other because they are electrically different, that is, they are surrounded by atmospheres of expanded ether bearing the relation of positive and negative, as with sensible bodies already described. It may be inferred that the acid molecule is surrounded by the positive atmosphere because its composition is H2SO4, of non-metallic elements, while the zinc molecule contains but one element, Zn. The precipitation of a molecule of zinc upon a molecule of the acid, would then result from the outside pressure of the medium, as in the union of the pith ball and the glass, or a planet and a star. The resulting commotion would cause the uniting molecules to break up and then settle into some different plane of stability, resulting in a new compound, zinc sulphate, (ZnSO4), from which the hydrogen (H) has been expelled or replaced by the zinc. A part of the internal motion resulting from a number of such unions would be communicated to the ether in the diffused form, hence a field of expansion embracing the field of action and with its inside pressure, would be the result. The ether in the strip of copper, in the wire and in the water, would offer a direction of least resistance to the positive field, hence the positive current in that direction with a weaker negative current in the opposite direction as described elswhere. While passing thru the circuit the positive current would cool somewhat by radiation, and would return to the field in a more reduced form, and so would not be repelled by the field. As mentioned in §32, there is something like this in the convective currents of ponderable matter, which comes under the same general laws.

The metals which can be used in generating the electric current have been arranged in a series so that any two in the series when used together, the direction of the positive current will be from the one uppermost in the series to the other, and the strength of the current will depend on their distance apart in the series. They are named as follows; zinc, lead, tin, antimony, iron, brass, copper, silver, gold, platinum. Zinc and lead when used together will produce a feeble current; with zinc and tin the current is a little stronger; with zinc and antimony it is more so and so on to the end. It seems that the conducting capacity for electricity ought to increase in the same order after zinc, but as to this I am not informed.

In the chemical action of the voltaic battery the hydrogen of the acid, as before mentioned, is set free. When the battery is in action if we place a galvanometer in the circuit, it will be noticed that the current gradually becomes weaker and that it can be renewed in strength by lifting the strip of copper out of the solution and brushing off the bubbles of hydrogen which have gathered on its surface. Even a slight motion of the copper in the solution will increase the current by detaching the hydrogen which rises to the surface of the solution. It is thus evident that the hydrogen which is liberated on the strip of zinc, is conveyed to the copper with the current instead of being conveyed to the surface by the buoyant force of the solution. It is also evident that there is a real current, a moving body of something, and what can it be if not the ether?

If we cut the wire which completes the circuit and place the two ends in water a short distance apart, the water will be decomposed by the action of the current which crosses the interval between the ends of the wire. This action occurs at the point where the current enters the water. Each molecule of water is made up of two molecules of hydrogen and one of oxygen, (H2O). In the act of decomposition the oxygen collects on the end of the wire where the current enters the water, and the hydrogen, as in the case of the battery above described, is conveyed with the current to the other terminal, where the current leaves the water, and there it collects. The two gases separated in this way, may be collected from the two ends of the wire. The fact that hydrogen gas is sixteen times lighter than oxygen gas, and for other reasons, it seems that the mechanical law of segregation (which compels like to seek like) will explain why they are separated. In some way which must be inferred from mechanical laws because it cannot be seen, the stream of ether, like an air blast, strikes among the molecules of water, which are charged by atmospheres of negative ether, resulting in the breaking up of their equilibrium and the separation of their elements. The elements thus confused together and mixed with the ether, might fall imto a different plane of stability, and this possibly would be that in which like is joined to like as required by segregation. After the gases were formed but still more or less mixed together, they would separate for the simple reason that hydrogen is the lightest and therefore most apt to be expelled by the current and by the buoyant force of the oxygen, which force would result from the outside pressure due to the expanded ether at the point of decomposition. Thus the oxygen is retained by outside pressure and by the superior mass of its units, while the hydrogen is expelled by the buoyant force of the oxygen and the greater lightness of its units. The direction of least resistance for the hydrogen would not be upward as due to the buoyant force of the water, nor downward as due to gravity, but with the current toward the point where it enters the wire, and here it collects in bubbles which are lifted to the surface by the buoyant force of the water. The oxygen which collects at the other terminal, is carried to the surface in the same way. This, in brief, is the theory of voltaic currents, also the theory of electro-chemical decomposition suggested by the general mechanical theory, and tho it may not be strictly true at all points it seems to at least point the way to the truth.

Experiment shows that electricity requires time in passing thru a conductor and that the time is proportional to the length of the conductor. It is also known that the velocity of the electric current thru a wire is about the same as that of light. If light travels at the rate of 186,000 miles per second it seems certain that there must be some difference of form in the electric current which travels to a long distance, as compared to that of friction which reaches only to a short distance. That of a wire which moves with the velocity of light should have the form of waves in which only the motion is transmitted, while that of lightning, friction and in some cases that of chemical action, should have the form of a moving substance.

34. Other Forms of Electricity.— Two parallel wires conveying currents of electricity in the same direction will attract each other. If the currents flow in oppsite directions, they repel each other. When such wires are coiled in the form called a helix they attract and repel the same as before. If coiled around a bar of soft iron the iron is converted into an electro-magnet. Two such magnets attract and repel each other the same as permanent steel magnets, but they are not permanent, for they lose this power the moment the current is stopped.

It is recorded that these facts led the French electrician Ampere, to devise his theory of magnetism. In his day electricity was believed to be an imponderable fluid, and his idea as to what magnetism is, was briefly this. To acount for the fact that a bar of iron becomes a magnet when placed in a coil of wire carrying a current, he supposed that each molecule of both the iron and the permanent magnet, is surrounded by a small atmosphere of the electric fluid, and that this fluid is at rest in the un-magnetized iron, but in constant motion in the permanent magnet. The act of converting the iron into a magnet consists in giving these atmospheres of electricity a whirling motion, and this is done by passing a current of electricity around them. The form of this motion was supposed to be whirling currents of a fluid substance, either around the molecules themselves, or around small aggregates of them. The axis of rotation took the direction of the magnetic force which was at a right angle to the direction of the current as in parallel wires.

Now it is worthy of notice that under this theory, all the facts of electro-magnetism and ordinary magnetism have been united and harmonized, only coming short of their ultimate explanation. What attraction and repulsion is, or what electricity is in itself or in its relations to other forms of motion, this theory does not go that far. It will be seen that this idea of Ampere's was very likely a simple inference from sense experience, taken in the way that all right steps in theory should be taken. From our present point of view it proves to be a true idea because we can use it in our theory of the Universe.

From the present theory, two parallel wires conveying currents in the same direction would be forced together by outside pressure because there is little or no friction between them, and hence little or no internal expansion and inside pressure. But if the currents flow in opposite directions, the resulting friction gives rise to internal expansion and inside pressure, as in other cases of frictional electricity. What is true of parallel straight wires in this respect, would be true the same for circular currents, either in coiled wires, or around molecules; hence, magnetic attraction and repulsion is electric attraction and repulsion, and both are due to difference of pressure in the ether.

Since all the effects of an ordinary magnet may be produced by currents of ether in a coiled wire, it follows that the currents of ether in a permanent magnet may induce electric currents in a wire which has no current. If such a magnet is brought close to a copper wire which is connected with a galvanometer, the presence of a momentary current is noticed in the wire. If one of the poles of a dar magnet be thrust into a coil of wire connected with a galvanometer, a momentary but stronger current is started in the wire. When the magnet is withdrawn and its opposite end thrust into the coil, the current is reversed. Now if a bar of soft iron be placed in the coil, and a magnet be presented to its end, the iron will be converted into a temporary electro-magnet, and will be able to induce a similar current in the wire. This induced current may be rapidly reversed by rapidly changing the poles of the permanent magnet. In this way a magneto-electric machine, which will furnish a strong current, is produced. The same effect may be obtained without the magnet, by the use of electricity alone. If a wire carrying the current of a voltaic battery be suddenly brought close to a wire which is connected wlth a galvanometer, a current will appear in the latter wire the same as when the magnet is used. This induced current flows in the opposite direction and is of short duration, a mere wave-like movement, in all respects like the one induced by the magnet, but it cannot be made useful by reason of its weakness. All these effects, and others that might be mentioned, reveal the intimate relationship of electricity and magnetism, how they change into each other and how perfectly they conform to our assumption that both are the same motion of the same substance, appearing in different forms. At present it is beyond my experimental means to enter thoroughly into a treatment of this part of the subject, and in a work like this, which aims for a general theory, it would hardly be expected. So far the facts have been obtained from authoritative books on the subject, but what follows has not.

The efficiency of the permanent magnet as a means of imparting motion to the ether in the wire, depends on the fact that the ether in the poles of the magnet is in constant motion in a known direction, as due to the inertia of the whole earth, and that this moving ether being confined to the magnet, is a movement of the ether itself in a body thru the medium, and that by suitable contrivance this motion may be imparted directly to the ether in the wire and in the form by which it can be conveyed to a distance and in quantities available for work.

Heat may be changed directly or indirectly into electricity in several ways, prominent among them being the thermo-electric battery. Two metals which differ in conducting capacity, and each having the form of a small straight bar, when soldered together, the end of one to the end of the other so that they form an acute angle, and having their opposite ends united by a conducting wire, will give rise to an electric current when heat is applied at the point of union of the two metals. The more the metals differ in conducting capacity the stronger will be the current. Bismuth and antimony differ widely in this respect and are therefore well adapted to the production of a current. The direction of the current is always from bismuth to antimony, across the heated juncture, and from antimony to bismuth thru the wire, or from the worst to the best conductor thru the heat, antimony being the best conductor. Experiment has shown that a number of metals may be used in this form of battery, and that they may be named in a series, the direction of the current being from any one above to any one below in the list; and the further apart they are in the list the stronger will be the current. They are named as follows: bismuth, platinum, lead, tin, copper, silver, zinc, iron, antimony.

As required by the present electro-mechanical theory the electric current must always depend on the presence of two separate expanded fields in the ether, one of which is more expanded than the other, or one positive and the other negative, and the two connected by a conductor. In the thermo-electric battery above noted, it seems that we have everything necessary to produce the electric current directly from heat. When heat is applied to the joined ends of the bars of dissimilar metals, molecular motion is imparted to each metal. From the physical difference in the molecules of the metals, arises the different degrees of expansion in the ether and hence the two electricities, which flow together and so give rise to the thermo-current.

When the current from a voltaic battery or from any source is passed thru the metals when cold, and across the juncture from antimony to bismuth, or from the good to the bad conductor, the juncture is heated. If the current is made to pass in the opposite direction, the juncture is cooled. This seems to be a good illustration of the fact that heat and electricity are both forms of the same motion, convertable into each other, and it seems to agree perfectly with the idea that the electric current, in passing from a good conductor into a bad conductor, or from a medium of little resistance to one of greater resistance, that in the latter there is necessarily a transfer of a part of the motion of the ether in the current, to the molecules of the bad conductor, and which transferred motion appears again as heat. On the other hand, in passing from the bad conductor into the good conductor, there is necessarily a diffusion of the motion of the current at the point of juncture which must reduce its temperature, hence the cooling effect. The same explanation applies to the fact that a wire which is a bad conductor of electricity is heated much more than a good conductor which conveys the same current. In the bad conductor some of the electric motion is intercepted by the molecules and changed into heat.

Atmospheric electricity was studied by Dr. Franklin, who found that a rod of copper used on a house as a pointed conductor for electric interchange between cloud and earth, was a protection to the house against injury by lightning. All the observed facts regarding lightning and the use of the lightning rod on buildings and vessels at sea, appears to agree perfectly with the mechanical theory. A genuine flash of lightning on a small scale, may be produced by suitable apparatus used in connection with an electric machine. A well known arrangement is to connect a small wooden house with the rubber of an electric machine, (which machine works on exactly the same plan as the glass rod and silk already described) and suspend a small metallic sphere three or four inches above the house, and connect it with the prime conductor of the machine, which is the source of the positive current. When the machine is worked the sphere is charged positive, and the house and the rubber with the earth connection, is negative. The sphere represents an electrified cloud, which is a dangerous source of lightning. The air between the house and the cloud contains more dense ether which separates the two expanded fields and resists their tendency to unite. When the machine is worked for a short time the expansive energy of the two fields, in particular that of the cloud, becomes great enough under outside pressure to cause it to break thru this intervening stratum of ether, hence the discharge which we call a stroke of lightning. Now if we set up a needle on the roof of the house in an erect position, and having its lower end in contact with a wire which connects it with the rubber or with the earth, exactly as we would put up a lightning rod on an ordinary house, then there is no sudden discharge or flash of lightning, no matter how long or rapidly the machine is worked. The needle or lightning rod simply serves to puncture the stratum of more dense ether which separates the house and the cloud, thus allowing a continuous and imperceptible discharge which releives the tension of the cloud, hence the protective value of the lightning rod. Whatever be the cause of atmospheric electricity it is always confined to clouds of aqueous vapor, and it is thought that the condensation of this vapor is its main source. When one electrified cloud comes near another, a discharge may take place from one to the other, thus showing a difference of electric tension. But most often the discharge is from the cloud to the earth, a common fact of the stroke of lightning being that it always takes the direction of least resistance which is toward and thru the nearest conductor. If the conductor is a good one, there is little or no danger; if not, there is and the danger is directly proportional to the resistance and the power of the discharge.

35. THE FORMS OF ELECTRICITY COMPARED.— Dr. Franklin proved the identity of lightning and electricity by charging a Leyden Jar with electricity from the clouds by means of a kite. This experiment should live long in human history because no doubt it was suggested as a simple inference from sense experience. He also performed other experiments with the same electricity which he got from the clouds. The Leyden Jar may be charged from a voltaic battery, a thermo-pile, a dynamo or an

electric machine, and it is always the same electricity no matter what its source, and electricity is expanded positive or negative ether, as required by the present theory. These facts, and others that might be mentioned here, are suggestive at least.

There is a noteworthy difference between voltaic and frictional electricity, which is also suggestive. The force which urges forward a current of voltaic electricity thru a wire is far inferior to that which impels a discharge of frictional electricity thru a suitable conductor. It is stated that a current from a battery of a thousand cells cannot jump across an interval of air 1-1000 of an inch, while a machine of ordinary capacity can force a discharge thru a stratum of air five or six thousand times that distance. The reason for this difference seems plain at once from our present point of view. Frictional electricity is necessarily developed on nonconductors and therefore not converted into molecular atmospheres and conducted away, or communicated from one molecule to another thru the conductor, but must be communicated directly to the medium of ether in the diffused form, producing an expanded field which is more voluminous and diffused than the other, hence outside pressure is more available in giving it the electro-motive force. The voltaic electricity, on the other hand, being directly communicated to the molecules, from one to another, thru the conductor, and so being strung out thru a long slender wire, do not possess the volume or form of volume that would be effective for the lateral pressure of the medium, which would be necessary to project it from the end of the wire; hence the difference.

Electricity generally appears like something which has a measurable quantity. When the quantity of electricity imparted to an insulated body is doubled, its volume is doubled; when the quantity is trebled the volume is proportionly increased, and so on. These facts are in no way damaging to the mechanical theory, in fact they are directly confirmative.

The quantity and volume of the electricity on an insulated metallic sphere is equal at all points on its surface. On a flat plate the quantity is greater at the edges and tends to escape into the air, (in particular if the air contains moisture) from all sharp corners or points. On an elongated cylinder-like conductor with rounded ends, like those used in electric experiments, the quantity is greater at the ends. In a straight bar magnet, also in a horse-shoe magnet, the whirling currents of ether are confined to the ends of the bar. It is supposed by some that the magnetism of the two poles is different in kind, since the north pole of one bar magnet always repels the north pole of another bar magnet, but attracts the south pole. But this may be a mistake because the facts can be explained quite as well on the theory of whirling currents of ether which attract when they whirl in the same direction and repel when they whirl in the opposite direction. (§34.) To make the pole of one magnet attract the same pole of another, it is necessary to reverse the current in one of them, and this can be done by turning it end for end. These facts are intelligible in view of the mechanical theory.

When a permanent straight bar magnet is cut in two at a point half way between its ends, the magnetism of each end divides itself into two equal portions, one portion being removed to the opposite end of the smaller bar, thus forming two complete but smaller magnets, exactly like the larger one, but of only one half the strength. These smaller magnets may be divided in the same way and always with the same result. It will be noticed that the magnetism of each pole is divided and one half changed into the magnetism of the other pole; a fact which is not in harmony with older theories.

When one pole of a bar magnet is applied to a bar of unmagnetized steel of similar shape, the steel bar will be converted into a new and permanent magnet exactly like the applied magnet. This is called magnetic induction. The induced magnet is like the other in all respects. It may be divided into smaller magnets like those from the division of the inducing magnet. To explain this fact we simply suppose that the ether in the unmagnetized bar of steel was set in motion; or rathe, its motion was changed into the form of whirling currents around the molecules of steel, and these being more rigidly in contact with each other, were necessarily forced into the form adapted to the current; and from which new form they are not likely to depart, owing to the more rigid structure of hardened steel over that of iron, hence the permanent magnet.

Many vegatable and animal substances when placed together will generate a feeble current of electricity. The belief once prevailed that the voltaic current was due entirely to the contact of two unlike metals, an intervening liquid being necessary to facilitate conduction. This is true to some extent, but subsequent research has proved that a strong cu rrent can only be obtained by chemical action which results in the decomposition of one of the metals. Thru further research it has appeared that all chemical action produces some electricity. The dry pile may be mentioned as a source of electricity without chemical action. Heat and light being almost the same in form, differing only in wave length, both ought to be sources of electricity, and this they are. Selenium has the property of generating an electric current under the action of light, and cases of the transformation of heat into electricity and magnetism have been described. So in all the forms of electricity and magnetism thus far considered we seem to see the same simple behavior of inert matter in its countless forms of motion.

CHAPTER SIXTH.

MYSTERIES OF CHEMISTRY.

36. GENERAL FACTS AND THEORIES.— As shown in preceding chapters the only theory of chemistry admissible under this general theory, is that of atoms and molecules immersed in the universal ether and governed by the laws of inertia. The molecule, not the atom, is now generally believed to be the ultimate unit in all chemical changes. A brief history of the steps which led up to this conclusion is the following.

In 1803 Dr. Dalton of England introduced the atomic theory of the ultimate nature of sensible bodies of matter. This theory has proved to be one of the landmarks in the history of chemistry, because it has enabled chemists to harmonize many of the facts, but not all. According to this theory sensible bodies are made up of very small indivisible particles of matter, which, in different bodies must differ in size and weight, but in the same substance all must be alike. These particles were called atoms, and it was first supposed that they were perfectly solid thruout their mass and indestructable. All chemical changes were effected by the combination or separation of these atoms. Being permanent, it was necessary for them to unite in certain constant proportions dependent on their mass, size or weight, hence the permanency of the properties of their compounds. For examples, one atom of one substance unites with one of another, or one of the first with two, three or four of the second, or two of the first with three five or seven of the second, and so on to certain limits, and in no other proportions. The relative weights of these atoms were their combining numbers or the chemical equivalent of the substance which they form. For example, a portion of oxygen gas by weight always combines with a portion of hydrogen gas weighing just 1-16th as much, to form water, and so with other compounds.

Now it is claimed that subsequent research has established the fact that all the elementry bodies, as hydrogen, oxygen, carbon, nitrogen, sulphur and the metals, always combine in definite proportions as above indicated, and just as would be required by Dalton's theory of indivisible atoms. But it is also found that most of the elements which combine in equal volumes, undergo no condensation. For example, two equal volumes, one of hydrogen and one of chlorine, when united, form the same two volumes of chloro-hydric acid gas. There are also cases in which the volumes of the separate elements are reduced to 1-3, and even to 1-2. Now it is said that from certain physical laws regarding the compressibility and expansibility of all gases, it must be supposed that equal volumes of all gases should contain the same number of molecules. Hence it would follow that the so called elemenatry atoms which form such compounds, are really not atoms, but molecules, since they must be divided into smaller parts in the act of combining. Exactly what evidence there is for this conclusion, offered by others, I have not been able to learn, but in the course of this chapter it will appear from this general mechanical theory, that the ultimate chemical units or smallest portions of matter which can take part in chemical changes, and which are now rightly called molecules because they are divisible into smaller parts, are really so divisible for other and purely mechanical reasons. I will try to make it clear that the smallest portions of the elementary bodies are composed of still smaller particles of matter, perhaps true atoms, and that permanency, as well as the fact that they combine in definite proportions, may be explained in another way without the assumption of indivisible atoms as chemical units, and in strict conformity to the laws of motion which we derive from the inertia of matter. Before taking up this part of the subject it will be necessary to mention a few more general facts of chemistry, which may be familiar to chemists but not so to the general reader who is not a special student of this science.

The properties of a substance are supposed to be its actual or possible activities or changes—the way it may effect the observer as in sense experience, when it is brought in contact with other substances, or tbe way it may be effected by the addition or withdrawal of motion.

Difference in properties is supposed to depend in some mysterious way upon the inner nature of the molecule or the atoms of which it is composed—upon their form, mass, mode of activity or power of attraction and repulsion.

The identity of different portions of a substance, and the constancy of its properties, is due to the perfect likeness and constancy of all its molecules. For example, pure water is always like pure water, because its molecules are all alike and always alike. The difference between one substance and another, depends upon a difference in their molecules. For example, alcohol is not like water, because its molecules, tho alike in themselves, are not like those of water, and so with other substances. The word molecule is here applied to the chemical unit as well as to the unit of the compound.

Every action that causes a change in the molecule, is called a chemical action, and every chemical action produces a change in the properties of a substance. This change of properties is said to be a change of the substance into a different substance. Thus by the simple union of the two gases, oxygen and hydrogen, water is produced, and so in other cases. The forms of these changes are numerous and complex, but all may be roughly classed as follows:

Unlike molecules may act upon each other with interchange of parts, thus altering the form of the molecules of each substance and so giving rise to two new substances. In such cases all the parts of the original molecules may be retained in the new ones, or a part may be expelled. This is the most common form of chemical action and it is called mutual decomposition.

The molecules of a compound may be divided into two or more smaller molecules, thus forming two or more new substances. This is called chemical analysis.

Two or more molecules, either of the elements or the compounds, may unite to form a new substance. This is called chemical synthesis.

Simply a change of position among the parts of the molecule is supposed to result in a change of properties, and therefore a new substance. This is called isomerism.

It is believed by many chemists that the molecules of the same substance may either divide into smaller molecules, or unite to form larger molecules, thus changing the properties of a substance. This is called allotropism.

In view of the theory that there is but one kind of matter in the universe, the above facts regarding the origin of the various properties of matter, seem to be altogether confirmative. They afford absolutely no ground for the belief that there is more than one substance in the universe; while they plainly reveal the possibility of explaining all differences in matter and therefore all material things, as purely physical—forms of one matter and forms of one motion. This of course applies only to the physical side of the universe.

In all chemical changes the quantity of matter taking part in the action can neither be increased nor diminished without the addition or removal of matter. This is to be expected from the law that matter in all its most complex transformations is never created or destroyed, and chemistry furnishes many good illustrations of this truth.

All chemical changes are attended by a manifestation of energy in one or more of its forms, and in all such changes the quantity of energy taking part in the action gives no sign of being increased or diminished without the addition or subtraction of energy. This fact is in perfect harmony with the general law of the conservation of energy, and chemical facts in general are in harmony with it. The laws of the conservation of matter and energy are now regarded as the foundation of all quantitative chemical investigations, and according to this more general theory, when we say matter and energy we mean matter and motion under the common physical laws.

Since chemical combinations always take place between fixed proportions, it is possible to determine the relative weights of the smallest portions of the elements which enter into the compounds. These smallest portions are supposed to be the individual molecules themselves, but their weights being only relative, can reveal nothing as to the actual weight of the molecules. Beginning with hydrogen as the lightest known substance and estimated as 1, the numbers run as follows; boron 11, carbon 12, nitrogen 14, oxygen 16, and so on up to the rare and heavy metals as high as 231.4, in all 63, known as the elements.

The molecules of all substances, in particular those of gases and liquids, appear to exercise an influence upon each other which is independent of their individual mass or motion. A given volume of hydrogen is 35.5 lighter than an equal volume of chlorine, and these bodies are both gases at ordinary temperatures. It is therefore supposed that the hydrogen molecule must be much smaller or less massive than the molecule of chlorine, and they must be held at greater distances apart. Many similar examples might be given, in fact experimental chemistry plainly teaches that like molecules, those of the same substance, exercise a repulsive action upon each other, which keeps them at regular intervals apart, thus preserving the liquid or gaseous form of the body of matter to which they belong.

Experiment also teaches with equal certainty, that unlike molecules, those of different substances, exercise an attractive influence upon each other, which enables them to combine as in the various compounds. Thus, like molecules, those of the same substance, repel each other, while unlike molecules, those of different substances, attract each other. This is a general fact of chemistry with but a few exceptions to be noticed later, and in view of our electro-chemical-mechanical theory, it is a most significant truth. The great importance of this truth is evident at once. The fact of molecular repulsion enables the various bodies to exist in the liquid or gaseous form at ordinary temperatures, or to assume that form by the absorption of motion, while the fact of molecular attraction enables the various substances which have an affinity for each other to combine as in the numerous compounds.

The above are a few of the principal facts of chemistry from the most trustworthy books on the subject known to me, and to which I would call attention by way of introduction to what follows. These facts or theories have not been reproduced word for word, from familiar sources. The matter has been presented in the form suitable to the application of the present general mechanical theory, and that this compilation is really necessary, will be evident to the most careless reader.

37. THE THEORETICAL PROSPECT.— From the literature of the subject we learn, that thru all the past history of chemical science, an impenetrable veil has seemed to envelop the ultimate molecule, and to hide from view its internal structure, mode of activity, etc. And perhaps the most obscure of all its activities is its power of attraction and repulsion, upon which seems to depend the stability of all solids, the liquid and gaseous forms of matter and all chemical changes. From the ordinary point of view this molecular mystery may be looked upon as even more mysterious than the mystery of gravity or that of electricity, for the reason that some subetances posses the power of attraction to a far greater extent than others, out of all proportion to mass, thus being active chemical agents, and even that they can exercise both attraction and repulsion at the same time and in the same direction. It is known that the molecules differ in mass, that they differ widely in chemical energy and the number of simple or elementary molecules which may enter into the compound molecule is known; but as yet nothing has been arrived at as to their internal arrangement or selective action upon each other.

The mechanical theory of chemistry, which is the object of this chapter, is evidently the only one which will harmonize with the general mechanical theory which is the object of this book. According to this theory, there is nothing on the physical side of the universe but matter, its various forms, the motion of matter, its various forms and the inertia of matter; which last named is the first principle, which governs all physical activities. In theoretical chemistry, therefore, we have to deal only with forms of matter, forms of motion and the laws of motion. As already shown this view is the only one that makes for universal harmony. If we follow this lead it is then evident that the only difference between the molecules of one substance and another that we can think of, must be a physical difference; a difference of form in matter and motion. Under this idea of form is included difference of mass, internal arrangement of parts and forms of motion. All chemical changes, therefore, must depend on molecular form, and must manifest themselves as forms of motion. There is need of but one kind of matter in this theory, and as we proceed it will become more and more evident that we have no reason to think that more than one substance exists.

But the prospect is not discouraging; on the contrary it is decidedly encouraging, for there should be nothing in chemistry which may not be presented to the mind as a simple object lesson. The most complicated chemical changes should require nothing but a black-board and a piece of chalk to give a complete illustration of them, and the entire science ought to be learned as easily as learning to read. Space is the great blank upon and in which all existence plays its part. Nothing occurs outside of mind which may not be illustrated and taught as here described. If we could see the individual molecules and watch them in all their changes, we would discover no new principle nor would we observe any action which could not be explained from the motion of inert matter as described. This must be conceded because a new principle would interfere with the already established laws of motion, hence cannot exist. From all which it follows that our theory of chemistry must be a simple mechanical theory, which should fit nicely into our general mechanical theory.

In order to reveal the necessity of an interveneing medium and some form of motion, as a means to an explanation of the power of attraction and repulsion, it will be best to describe a well known experiment which seems to throw a new and significant light on this subject.

A quantity of ice may be gradually warmed from 1° F, up to 32° F, and the thermometer will indicate every degree in the rise of temperature. The efficiency of mercury as a means of measuring heat depends on its uniform expansion by heat, and heat is supposed to be the relative motion of the atoms or molecules; that is, their individnal vibrations as a whole, which, when increased, results in the expansion of the body and is sensible as heat. It follows, therefore, that the ice contains molecular motion and that this motion may be increased by the addition of motion from without until 32°, the melting point of ice, is reached. Now at this point the ice begins to assume the form called water, and right here a noteworthy fact is observed. The mercury still stands at 32°, and it has stood there during the whole time the ice has been melting, nevertheless there has been a steady inflow of heat. But as soon as the last bit of ice has been melted the mercury begins to indicate a rise of temperature, which steadily increases untill the boiling point 212°, is reached. Thus, to the most reliable test, a quantity of heat has been changed into some other form of motion which is not heat (or not the motion of the molecule as a whole) because it cannot communicate itself to the mercury. Now, notice that as a clear result of this experiment, we have the molecular repulsive force which is necessary to maintain the water in its liquid form.

The same result may be brought out in a modified form of the same experiment. If a pound of ice at 32°, be mixed with a pound of water at 172°, the ice will rapidly melt, but the temperature of the resulting two pounds of water will be reduced to 32°. There has therefore disappeared, during the change of the ice into water, 140 units of heat, which had previously raised the pound of water from 32° up to 172°. Since the thermometer has failed to give any account of this heat, we must suppose that it has changed into some other form which is not heat, and the molecular repulsive force being to all appearance a direct result of the absorbed heat, the new form of motion is evidently not that of the molecule as a whole.

In still another form of this experiment we get the same result. If a pound of ice and a pound of water, both at 32°, be exposed to a uniform source of heat while in separate vessels, it will be found that by the time the ice is completely melted, the heat of the water will have been raised to 172°, while the water from the melting of the ice will still stand at 32°. As in both the other cases, 140 units of heat have passed into the water without raising its temperature one degree, but with the noteworthy result of giving each molecule a repulsive force which enables it to keep at a certain distance from adjacent molecules, and which force or motion is not communicated to the mercury as heat would be.

From all of which it follows that if heat is a motion of the mass of the molecule, all in one direction until it strikes and rebounds in some other direction, and if the quantity of motion which was absorbed by the melting ice was uniformly distributed among all the molecules, (and this view seems unavoidable) then it simply follows that the molecules of water which took part in the above experiment, must be constructed on some plan which enables them to change this absorbed motion into some other form which is not heat. So we have to inquire what is the form of a molecule which would enable it to receive motion and transform it into other forms, not that of heat.

The laws of inertia and relativity permit us to entertain but two ideas regardiug the form of the ultimate units of sensible bodies. (1), They are single, solid particles of matter, having no internal section or separate parts, like the atoms of Dalton. (2), They are composed of a number of such atoms, held together in groups by some mechanical means. We are limited to these two forms. The molecule of the elementary bodies, must be either a single atom or a collection of them. A single atom can have but two independent forms of motion; (1), a revolving motion on its axis; (2), a straight line motion as in heat. The molecule of water cannot be a single atom because we know it was formed by the union of two volumes of hydrogen and one volume of oxygen; hence it must be a group of possibly a large number of much smaller atoms. The rotation of a single atom, no matter how rapid, could not communicate the effects of heat as all bodies are expanded by heat. It is the straight line motion of the molecule as a whole, limited by other molecules and transferable to them, which gives us the heating effect; and since the above experiment plainly shows that the large amount of heat absorbed by the ice in melting does not continue to exist as heat, and that as a result we have instead the liquid form of water, it is perfectly natural and right to suppose that the new form of motion is this repulsive force.

It is at least extremely doubtful whether the whirling motion of a single atom could have any heating or expanding effect, nor could it act upon other molecules without coming in contact with them. Hence it seems certain that we must give up the first mentioned form of the molecule, (which requires it to contain but one atom) and adopt the second form, which requires it to contain a number of atoms. We are then to proceed with a molecule which contains a number of atoms, possiblly a large number. In this case the absorbed motion which gives rise to the liquid water, and which must be distributed equally among all the molecules, but which is not heat, nor is it a whirling motion of the individual molecule or its component atoms, must be some form which enables it to act across the interval between it and its nearest neighbors. We know that there is no action thru empty space, so this action must be thru a material medium, in fact we must admit a mechanical repulsive force exactly as described in §19.

The internal straight line motion of the atoms in the molecule, is clearly a possible result of the absorbed motion. But this, in itself, would not amount to a repulsive force, so we cannot do without the inter-molecular medium, and this of course is the ether already described as being composed of particles of inert matter, and therefore governed by mechanical laws. And this medium is not only necessary to bridge the space between the molecules, but it is indispensible to the mechanical action which promises to explain and harmonize a long line of other facts of chemistry. General harmony is what we want.

38. MOLECULAR ATTRACTION AND REPULSION.— As already mentioned, chemists generally believe that the smallest chemical units of at least most of the elementary bodies, are real molecules, containing a number of atoms, and some of them a large number. Since this theory is well supported by facts and authoritive opinions, besides the evidence given in §37, we are justified in accepting it here.

According to this view, a body of elementary gas, oxygen or hydrogen for example, is a collection of insensiblly small portions of matter, properly called molecules, because each one of them is a group of still smaller particles of matter, which, for reasons to appear later should be called atoms. These atoms are supposed to be free from each other so far as to be capable of relative motion; but they are held together by a force soon to be described. Thus the molecule becomes at once an absorber of wave motion from the general medium (light or heat) which is continually passing in all directions. At least a considerable part of this absorbed motion will take the form of a confused right line motion of the atoms, thus expanding the molecule and tending to scatter its atoms. The atoms being much smaller than the molecule as a whole, are not able to communicate their motion directly to other molecules as heat. The molecule, or group of atoms, being immersed in the ether, there is a continuous transfer of its absorbed motion to the ether. This transferred motion will necessarily take the form of a confused right line motion of the particles of the ether, like that of the atoms, and which will expand the ether within and immediately around the molecule. Each molecule is thus a radiator of motion in all directions thru the ether, and the quantity of this motion will diminish as the square of the distance from the center of the molecule. The ether being thus expanded within and close around the molecule, will exert a difference of pressure on the atoms, tending to force them toward the center of the molecule. In this way the atoms of each molecule are kept together, and the individuality of the molecule is preserved. It will not be difficult to see that the atoms in such a molecule cannot communicate their motion to adjacent molecules as heat.

According to our general mechanical theory this difference of pressure which keeps the atoms of the molecule together, is the same that gives rise to weight or falling motion at the surface of the earth; it is the same that keeps the moon, the earth and all the planets in their orbits; it is the same that gives rise to all the forms of electric and magnetic attraction and as will be explained later, it is the same agent in chemical affinity. In preceeding chapter this difference of pressure has been explained on a large scale and need not have further attention here.

The molecules being all alike thruout the body of gas or liquid, each containing the same number of atoms and quantity of matter, they would absorbe and radiate motion alike, hence their atmospheres of expanded ether (electricity) would be uniformly the same. As already explained, the difference between positive and negative electricity is a difference in degree of expansion in the ether, due to a physical difference in the molecules of different bodies. Two bodies charged with the same electricity, (either positive or negative) always repel each other, while two bodies charged with different electricities, (one positive and the other negative) always attract each other. Or, according to the mechanical theory, two atmospheres of expanded ether due to like molecules (those of the same substance) would repel each other, and two atmospheres of expanded ether arising from different molecules, (those of different substances) will attract each other. A simple experiment in electricity will reveal this action to the eye, so far as it can be seen. Suspend a number of pith balls by fine silk threads, near each other, and electrify them by rubbing a glass rod. They repel each other and take positions at equal distances apart. Next charge them by rubbing a stick of sealing-wax. The result is the same. Now take two of the balls, charge one from the glass and the other from the wax. They immediately attract each other and stay together as long as the charge lasts. From which it appears highly probable that electric attraction and repulsion and molecular attraction and repulsion are due to the same physical cause. To make sure of this we have to carefully examine the general facts of chemistry as now presented in the books.

Here it will be best to call attention to the mechan cal law of segregation, in order to help us to a better understanding of molecular phenomena. All ponderable bodies from the atoms up, are continually moving and changing relations, and there is always and everywhere a tendency toward uniform equilibrium as a result of a uniform diffusion of motion. The most perfect state of equilibrium is that in which mechanical uniformity is reached thru this diffusion of motion. This is accomplished most completely when particles, atoms, molecules or moler aggregates, which are all alike in all respects are grouped together; and there is always a tendency for bodies alike in this respect, to get together and remain together. There are a number of examples of this truth presented to the eye and occuring under the combined action of gravity and moving currents of air or water. It is the agency which separates wheat from chaff, it is the same that separates gravel from sand and mud in the beds of rivers, also the different grades of sand and gravel, and it is employed in separating the different grades of emery powder. In the past history of the earth segregation was undoubtedly at work in the formation of the different rock and soil deposits. To account for this general truth under physical law it seems necessary to proceed as follows. Motion always tends toward uniform diffusion among all bodies or particles of matter, whether ponderable or imponderable. In the complete attainment of this state of uniform diffusion, each body or particle would contain a quantity of motion proportional to its quantity of matter. If the smallest atom contains one hundred times as much matter as the particle of ether, it will move with the same velocity, but it will contain one hundred times as much motion and the motion will be all in one direction while that of a hundred particles of the ether will be in all directions. All ponderable bodies from the atoms up, are at all times subject to friction, because they move thru the ether and other gases and liquids, hence they are subject to more or less loss of motion. But the ether particles, moving thru empty space, and totally without friction, must move with the greatest possible velocity. The ether is thus a constant absorber of motion from all the ponderable bodies, thru friction and in the forms of electricity, light and heat; and the same motion is continually being returned to ponderable matter from the ether as absorbed light and heat, and as accelerated falling motion. The ether, owing to its form, (which makes it a perfect medium) is thus a means for the diffusion of motion toward uniformity; while it is thru the collision of the atoms and their aggregates, which continually interferes with the attainment of a complete uniformity. When motion is imparted to a ponderable body, large or small, it is necessarily concentrated, because all parts of it must move in one direction. When two such bodies meet in collision their motion is more or less changed into a relative motion of their components, (if they are compounds) and from these the motion is transferred to the ether as heat, light or eleciricity; hence the concentration followed by diffusion.

The difference in mechanical deportment between the ether and the atoms, according to this theory, must be due entirely to their difference of mass or quantity of matter. The ether particles must be very much smaller, perhaps thousands of times smaller than the smallest atom. This great difference of mass would give to the ether, as a medium, all the mechanical properties necessary to its playing the part we see in molecular and electric phenomena. The particles of the ether would never unite in groups to form molecules, because they are the smallest and all the same in mass, hence the outside pressure necessary to hold them together would be impossble. But the atoms being much larger, and very likely moving slower in proportion to mass, would be susceptible to the outside pressure of the medium, and wonld form groups as in the elementary molecules. As required by segregation, atoms of the same size would get together and remain together, simply as a result of their physical likeness, while two atoms differing in this respect, would carry different quantities of motion, and so would separate. In this way a series of elementary bodies might exist in which the ultimate molecules would contain a number of atoms all alike, while in different elements they would be larger or smaller. In the case of compounds, in which the molecules are composed of atoms differing in mass, each molecule should contain the same number of the different elementary atoms, and as required by segregation, the most massive atoms would occupy the center of the molecule, with the lighter and most numerous atoms disposed around the outside like the atmosphere of a planet.

To review the above, the elementary substances differ from each other by reason of the difference of mass in the atoms which compose their molecules, while the compounds differ from each other and from the elements, because their molecules are necessarily formed by the union of the different molecules of the elements, and that the different atoms in each molecule are only separated by placing the most massive in the center with the lighter ones around the outside. The reason why the elementary molecules are all alike in number and size of atoms, is simply a result of this universal tendency of like to seek like, also the tendency toward a uniform diffusion of motion. If by any chance one molecule should get more atoms than its neighbor, it would absorb more motion and eventually by inside pressure and self repulsion it would divide, as shown in electric experiments; that is, the normal balance between outside pressure from the medium and the inside expansive force of the atoms, would be overcome, and the molecule would divide by the expansive action of its atoms and by the self repulsion of its electric atmosphere. But the growth of a molecule in this way is not very probable. The intimate mixture of the atoms of a particular element with the ether, and the uniform diffusion of a certain quantity of motion in the medium, would undoubtedly bring about a state of stable equilibrium, in which the atoms would be grouped into uniform molecules, each repelling its neighbor as described, and as a simple result of the fact that the atoms are larger than the particles of the ether. The molecules being thus kept at regular distances apart, we would call this the state of stable equilibrium upon which the gas depends for its permanency within certainlimits of temperature; and the same would apply to all gases and liquids. In the case of solids, and to some extent gases and liquids, the law of segregation, along with the outside pressure of the ether, would account for the existence and stability of all solids or sensible bodies.

That the atoms are constituted as here described, seems to me to be the only way to account for the facts. A certain constant relation between the mass of the units of the ether, the mass of the atoms of the molecule, and the quantity of motion in the medium, would determine the number of atoms in the molecule, its electric repulsive power upon adjacent molecules, and the volume or specific gravity or density of the gas or liquid at a given temperature. In each molecule the atoms should be sufficiently nûmerous to make the molecule an absorber of wave motion from the medium, and to permit of its being divided into equal parts, as this is known to occur in the formation of certain compounds. As to whether the atoms of each elementary molecule, and the particles of the ether, are all exactly alike, in each division, can only be inferred from the governing law. This view agrees with Dalton's theory of atoms, but the atom in this case is not the chemical unit because it belongs to a lower plane of division. This theory is also in harmony with the law of the conservation of matter and motion, and so far as known to me it agrees with the chemical law of definite combining proportions. And more, it promises an explanation of the deep mystery of matter itself, which involves the ultimate nature of things. Chemical facts must be explained and harmonized somewhat as here indicated, in order to bring this department of science under general physical laws, and make of it in truth a physical science. Next let us examine a few of the general facts of chemistry and see if they fallinto line from this view point.

39. RECORD EVIDENCE.— It has been recorded by Kirchoff, Tyndall and others, that the various gases and liquids show a difference in capacity for absorbing wave motion from the medium, and it has been inferred that some molecules are more in accord with certain wave lengths than others, and hence better able to absorb motion. But we might also infer that the mass of the atoms in certain molecules is such as to enable them to vibrate in harmony with the waves, hence they are to some extent transparent to the wave motion; while the atoms in other molecules, owing to greater or less mass, are in discord, hence they would obstruct and break up the wave, and absorb and convert its motion into electricity by transferring it to the ether. To explain further, if the molecule was in harmony or if its atoms would vibrate with the waves to some extent or more or less, then it ought to be more or less transparent to the waves, and to the same extent not as good an absoiber of their motion. But the molecule must absorb some motion in order to maintain its individuality as a molecule. If on the contrary, the molecule was in discord with the wave length, then it would intercept the motion and convert it into the confused motion of the atoms and then impart it to the ether as electricity. This difference in capacity for taking in motion should be attended by a corresponding difference in capacity for radiating motion; a good absorber being a good radiator and a bad absorber a bad radiator. The quantity of motion radiated by a molecule would determine the quantity of its electric atmosphere, and this again would determine its power to act upon other and physically different molecules, as in chemical changes. As to whether two molecules would attract each other would depend upon their electric difference, and this, as already shown, would depend on molecular difference whereby plus or minus atmospheres of expanded ether are produced. In some cases this electric difference might be induced by electricity from an outside source. If one or a small number of molecules at a given point in a body of gas,

should receive a sudden increase to its electric atmosphere, it would then bear to the others as yet unchanged the relation of positive to their negative, and would attract them. In this case the added electricity would not originate in the molecule itself as transformed wave motion, hence the internal or atomic motion of the molecule would be increased but little if any, which little might result from combining. In this way it seems highly probable that like molecules might be induced to combine, thus changing the properties of a substance; and in this way it may be possible to account for the phenomena of allotropism, in which such changes are known to occur. Several elementary substances, notable among them being oxygen, carbon, sulphur and phosphorus, have the peculiar power of changing their properties while their fundamental identity remains the same. Oxygen for example, may be made to assume two other forms; ozone and antozone. When an electric machine is put in operation the odor of ozone is often noticed as a result of the escape of electricity in the air; this effect generally accompanying a discharge of this form, one fifth of the air being oxygen gas. Ozone is exceedingly unstable; being easily decomposed by the least rise of temperature. Thus it is formed out of oxygen by clectricity, and changed back into oxygen by heat; or, as we might say from the mechanical point of view, electricity makes electric difference, which tends to combination without increasing the atomic motion, while heat or molecular motion imparts the atomic motion which results in internal expansion and separation. Antozone is produced simultaneously with ozone and both are produced out of pure oxygen and may be changed back into pure oxygen. These facts may be readily understood from our mechanical point of view.

But cases in which like molecules combine are rare in chemmistry, in fact it is generally the opposite. Chemical affinity, with the few exceptions above mentioned, is exercised between bodies possessed of opposite properties, and in most cases the more unlike the molecules of two substances, the more they are apt to combine. In this respect chemical affinity is remarkably unlike cohesion, or that molecular likeness which, under segregation, tends to bring like molecules together and keep unlike molecules apart. The metals freely mix together when fused, as in the alloys, they adhere powerfully as in welding and to effect their solution, the only way is to mix them with mercury, which is the only liquid metal at ordinary temperatures. The salts disolve in water most readily when they resemble it by containing water in the crystallized form. Inflammable bodies, like phosphorus and sulphur, do not disolve in water nor in acids, but in liquids themselves inflammable, like sulphuric ether, bisulphate of carbon and the various oils, they disolve readily. The resins and solid fats also require for their solution similar oily and spirituous liquids, and finally, in perfect accord with the law of segregation, the most perfect solutions are obtained by mixing two portions of the same substance, in which there is perfect molecular likeness, as water with water. So we have as a very general thing, the truth, that the molecules which are the nearest alike are most apt to mix freely without chemical union, while the molecules which are most unlike, are least disposed to mix together, while they are most apt to attract each other and form new compounds. And this must be admitted from the mechanical point of view.

It seems that the most general comparison in illustration of this truth, is that of the metallic and nonmetallic elements. The metals as a rule are not soluble in water, alcohol, or any of the liquid compounds of the nonmetallic elements; but the metals promptly combine with the nonmetallic elements to form compounds, many of which are soluble in these liquids. Carbon may seem to offer some exception to this rule, perhaps because of its middle position between the metallic and nonmetallic elements. In all its forms carbon is an infusible solid, not affected by the highest temperature. The atomic weight of carbon is 12 and in some of its varieties it closely resembles the metals. Gas carbon is a solid, hard, brittle, substance, with the metallic luster, and it conducts electricity like the metals. In its chemical deportment it is still more like the metals, as it combines at once with most of the nonmetallic elements. With hydrogen, oxygen or nitrogen, or with two or all three of these elements, it combines in the most varied proportions, giving rise to a great variety of compounds, some of them highly complex. It is a noteworthy fact in view of this theory, that many of these compounds exist as gases or liquids at ordinary temperatures, and that all of them are fusible. A study of carbon in view of this theory, seems to indicate that its molecule contains only a few, and most likely only one atom. Tho it enters into many compounds it is never the active agent. This fact, with the fact that it is infusible, seems to make it very plain that its molecule is incapable of absorbing the motion which can be changed into an electric atmosphere of its own, (and which incapacity would result directly from a molecule containing but one atom) hence its molecules are not able to repel each other, so makeing the body to assume the form of a gas or a liquid. A molecule with one or only a few atoms would also have the shape best suited to unite with the more active elements. Oxygen is one of the most active of the chemical agents and with carbon alone it forms two compounds. When carbon is heated in air or in oxygen gas, the oxygen molecule promptly engulfs the carbon unit, each one of the former taking one of the latter, as in carbon protoxide (CO); or two of the former taking one of the latter, as in carbonic anhydride (CO2). Both of these compounds are gases at ordinary temperatures. It is therefore evident that the carbon molecules, which cannot be separated by the most intense heat, are quickly separated by their union with oxygen, which simply gives each one of them an atmosphere of smaller atoms by which they are able to absorb motion, convert it into electricity, and thus by repelling each other assume the form of a gas. Who could wish for anything more convincing than this?

We might even venture so far as to suppose that when carbon is heated to the incandescent point, its internal motion which is changed into light, is purely atomic; that is, its solid units move in all directions, strike together and rebound, thus expanding the ether between them thruout the body, and so increasing the outside pressure from the medium, which secures the body in its solid form. A sensible mass of carbon would then resemble somewhat the molecules of a semi-fluid, but very much larger, and its units or atoms would also be larger, thus sustaining the outside pressure necessary to maintain the rigid form of a solid. The three allotropic forms of carbon, plumbago, charcoal and diamond, indicate a tendency of its units to form into groups or molecules; and why they do not succeed, even so far as to produce a fusible body, seems explainable only by admitting that the units are too massive and slow in taking up the motion which would give the small groups of atoms the electric atmosphere necessary for them to repel each other. They seem to be just heavy enough to vibrate in mass with the ether wave, and so when heated to white heat, they are able to impart the same wave length to the ether. The fact that carbon in its transparent and translucent forms, as in the diamond, may be explained on the supposition that its atoms vibrate in harmony with the ether waves. The motion which passes thru the body as light, does not change into electricity, hence there is no tendency to form molecules. The body is thus a homogeneous solid, of crystalline structure similar to glass but much harder, and with its physical pores filled with ether, the density of which is close to that of the body. The diamond is not affected by the strongest acids or alkalies, and the only element capable of acting upon it is oxygen, and this only under a high temperature. When heated in oxygen gas it burns to carbonic acid gas (CO2). If heated between the white hot charcoal points of a powerful voltaic battery, it softens and swells up, forming a black brittle mass like coke. Thus the most highly prized form of ordinary matter may be changed to a comparatively worthles form, by the simple action of heat. Besides the three principal varieties of carbon, there are a number of sub-varieties which differ more or less in color, hardness, lustre specific gravity, behavior toward chemical agents, power of conducting heat and electricity and in other respects; but they are all alike in the fact, that, when heated in oxygen they unite with it to form the same compound (CO2). Now we can fairly suppose that these varieties differ from each other as a simple result of a difference in the number of atoms in their molecules; and which atom are differently combined as a result of a difference in the initiating temperatur. But when once combined they tend to maintain that form as a result of the general inertia of matter and persistency of motion. The transparency of the diamond would result from its uniform mass and power of transmitting the waves of light unbroken.

Of all the chemical elements fluorine, whose combining number is 19, is the most energetic. It is difficult to obtain it in the free state, for as soon as expelled from one compound it immediately attacks the nearest substance, and disappears in a new compound. Oxygen (16), ranks next to fluorine in chemical energy, and in this respect, these two are nearer alike than any two elements known. In view of the present mechanical theory it is worthy of remark that these two are the only elements in the list which refuse to unite chemically. They will mix intimately, but their molecules repel each other and keep apart. Nitrogen (14), and oxygen (16), are close to each other in molecular weight, but they differ widely in chemical energy. While oxygen is always active and even aggressive, nitrogen is noted for its indifference to other substances. These two elements combine in five different proportions, forming five different compounds. This fact at first sight may seem to forebode the fallacy of our theoiy, but we must not forget that the present scale of combining weights indicates nothing as to the actual weight of the atoms, or the number contained in the elementary molecules. The molecule of nitrogen may contain a small number of large atoms, while the molecule of oxygen may contain a large number of smaller atoms. The two elements may also differ in the power of absorbing the wave motion of the medium, and this no doubt is the direct source of their difference in chemical energy. Oxygen must absorb more motion than nitrogen, but why? If its atoms are more in accord with the ether waves, it seems certain that they would vibrate more freely with them, like the atoms of carbon in the diamond, and so the oxygen molecule would be more transparent to the motion. On the other hand, if the oxygen atoms were more in discord with the ether waves, they would interfere to some extent, and all motion thus intercepted would be communicated directly to the ether as electricity; hence the superior power of oxygen as a chemical agent. The same, of course, applies to all the active agents.

There is a series of compounds of carbon and hydrogen, fully described in the books, which are interesting in this connetion.

Beginning with methyl hydride or marsh gas, and giving only the formulas, which indicates the relative mass of the different molecules of nine compounds, they are as follows:

CH_4 a gas; C_2H_6 a gas; C_3H_8 a liquid, boiling point 30° below zero; C_4H_{10} b. p. 0° zero; C_5H_{12} b. p. 30° above zero; C_6H_{14} b. p. 60°; C_7H_{16} b. p. 90°; C_8H_{18} b. p. 120°; C_9H_{20} b. p. 160°.

It will be noticed that each member in the above series after the first, differs from the one preceding, by CH_2; and that as the quantity of matter in succeeding members increases at a uniform rate, there is a corresponding increase in their boiling point. This is all I can learn from the books about this series, but this much is exactly what we ought to expect from the present theory; and from the same theory we might infer that other properties, as specific gravity and perhaps chemical energy, should show a similar gradation. Thus, molecular mass, boiling point and specific gravity, should increase from the first member downwards, while chemical energy would most likely increase from the last member upwards, but there may not be a uniform increase in chemical energy from the bottom up. Since the first two in the series are gases, those occupying the middle of the series should be liquids, gradually changing downward from the lightest toward the heaviest, which approach the solid form.

A further illustration of the same truth may be found in the well defined group of elements known as chlorine, bromine and iodine. These elements have very little affinity for each other, but for hydrogen, nitrogen, oxygen and the metals, they manifest a strong affinity. With hydrogen they all combine in the proportion of equal volumes to form acids, which are all soluble in water besides possessing general properties that closely resemble. With nitrogen they each form an explosive compound which exhibits the mechanical series very plainly. That of chlorine is the most explosive, that of bromine less so and that of iodine the least. The combining weight of chlorine is 35. 5, of bromine 80, and of iodine 127. At ordinary temperatures chlorine is a gas, bromine a liquid and iodine a solid. The chemical energy of chlorine is the greatest, that of bromine second best and that of iodine the least; and so with all their properties, chlorine and iodine being at the beginning and the end of the series with bromine in the middle. All this is what we ought to expect in view of the mechanical theory.

There are other natural groups of the elements which justify this view. The following has the added interest of exhibiting the gradual transition from the non-metallic to the metallic form of the elements. They are nitrogen (14), phosphorus (31), arsenic (75), antimony (122), and bismuth (210). The metallic character is entirely absent in nitrogen, hardly discernible in phosphorus, more marked in arsenic, quite distinct in antimony and most decided in bismuth. The metallic character thus evidently depends on increased molecular mass, which in turn is due to increased atomic mass, and consequent inability to absorb the motion which may change into electricity. The metals generally seem to resemble carbon in so far as to suggest the probability that their molecules contain only a few, and possibly only one atom. Like carbon they are good conductors of both heat and electricity and they do not absorb heat or light and convert it directly into molecular electricity. Generally they seem to be transparent to heat just as the diamond is transparent to light. While they are all good conductors of heat and electricity, they are equally good as radiators, and this is to be expected. The capacity to impart motion must be equal to the capacity to receive it. Somewhat unlike carbon the metals are all fusible, but most of them require a high temperature and some of them, platinum for one, can be fused only in the most intense flame of the oxy-hydrogen blowpipe. It is a noteworthy fact, already aluded to, that the non-metallic elements, which are generally good absorbers and bad conductors of motion, combine readily with the metallic elements, which are generally bad absorbers and good conductors of motion. And as would be expected the compounds from such unions generally resemble the non-metallic elements as they are good absorbers and bad conductors, besides being active chemical agents, and many of them are soluble in water and other liquids. It is very obvious that when the metals combine with the non-metals, they acquire the atmospheres of smaller atoms, which enables them to convert heat and light into electricity, by which their molecules are able to attract their opposites and repel their likes.

According to some authorities, lead, tin and zinc are the worst conductors, and it is worthy of notice that, excepting mercury, their melting points are the lowest. In order to assume the state of liquid fusion the molecules, or at least the ultimate atoms of such bodies, must have some way of receiving the motion which enables them to keep apart and to vary their distance apart as the temperature varies. But are the atoms in such bodies really grouped into molecules, or are they uniformly diffused thruout the body? In the first case the absorbed motion might be changed into electricity and so aid in bringing about the state of fusion by molecular self repulsion. In the second case the atoms may be kept apart by their individual motion in straight lines, striking together and rebounding, as required by the laws of motion (§20). This last named view seems to me to be most apt to be true, and if so then the metallic elements, including carbon, may be supposed to have for their chemical units single solid atoms, while all the non-metallic and active elements, should have groups of smaller atoms.

In view of the law of segregation and of our present ideas of the form of the elementary molecule, we can arrive at some idea of the makeup of the compound molecule. For example, in the molecule of ammonia gas (NH_3), we would have an interior portion composed of one equivalent of the heavier atoms of nitrogen (N), entirely enveloped by three equivalents of the lighter atoms of hydrogen (H). Many similar examples may be mentioned, as the following: (OH_2), (CH_4), (SO_3), (SnS_2), ($PtCl_4$), (C_2OH_6), ($C_{18}O_{15}H_{30}$), and hundreds of others, the most multiplex of all being ($C_{75}So_{22}N_{18}H_{112}$). Among the few apparent exceptions to this rule may be mentioned (P_2H), Ag_2O), CN_2S) and (KCl). But in these compounds the active elements are H, O, S and Cl, among the most active of all. If we can conceive it as possible that one molecule of hydrogen (H), may be able to completely envelop two molecules of potassium (P), or one moleculo of oxygen (O), to engulf one molecule of silver (Ag), there is no difficulty in view of the present theory.

The behavior of compounds among themselves seems also to justify the mechanical theory; but since they are very numerous and complex a careful study of them without a more thorough knowledge of chemistry, is impossible at present. Perhaps the most noticeable relation is that between acids and bases. There is a well known class of compounds called acids, and another called bases, which readily unite with each other to form a third class of bodies called salts. Acids are generally composed of hydrogen and oxygen with some one of the non-metallic elements of greater weight, as nitrogen or sulphur. Bases are generally composed of the same hydrogen and oxygen with some one other of the metallic elements, as potassium, sodium or copper. Nitric acid (HNO_3), and sulphuric acid (H_2SO_4), are examples of the acids. Potassium hydrate (KHO), sodium hydrate (NaHO) and copper hydrate (CuH_2O_2), are examples of the bases. It is therefore quite possible that the relationship of the acids and bases is the same as that of the metallic and non-metallic elements; but with the compounds the scale of magnitudes is somewhat greater. The molecules of a base would possess a more massive interior than the molecules of an acid, hence as in other cases would have a different atmosphere of electricity, either positive or negative to that of the other. When we compare the formula of potassium nitrate (KNO_3), a base, with the formula of nitric acid (HNO_3), it may be seen that the acid molecule with its one volume of nitrogen for an interior, enveloped by three volumes of oxygen and one of hydrogen, is a much lighter molecule than the base with its one volume of potassium, one of nitrogen and three of oxygen. The difference in molecular weight is 63 for the acid to 101 for the base. For this and other reasons which give to the acid molecule a more complex atmosphere (since the potassium element is replaced by the more active hydrogen element) it is most likely that the acid is the positive agent.

I have now reviewed a few of the most general and conspicuous facts of chemistry in view of the present theory. The facts have been obtained from a brief reading of a few books and no practical experience has been attempted, as this was impossible. It is not claimed that what I have offered here is sufficient to establish the truth that all chemical changes are accounted for as the simple movements of one inert substance, divided into particles or atoms which differ in mass, and which are governed in all their movements by the motion which comes from inertia. It should be evident however, that some mechanical theory of chemistry must be devised in order to harmonize these facts with a complete mechanical theory of the physical universe.

40. EXPERIMENTAL RESEARCH BY OTHERS.— The extensive experiments of Prof. John Tyndall with radiant heat, as a means of determining the nature of the molecule, it seems to me are highly important as bearing evidence for the mechanical theory. His experiments were numerous and varied, with expensive apparatus, and every possible precaution was taken against error. I will mention a few of his results, in his own words, and as bearing on the present theory, and will refer the reader to his large work, "Contributions to Molecular Physics", New York, 1873. I have quoted these passages not to swell the volume of my own book but to make it plain that the ablest men of the last century have done something to prepare the way for a general mechanical theory. On the subject of molecular absorption and radiation, Prof. Tyndall says at the end of a long series of experiments. (page 47):

"From the existence of absorption, we may infallibly infer a capacity for radiation; from the existence of radiation we may with equal certainty infer a capacity for absorption, and each of them must be regarded as a measure of the other. This reasoning founded simply on the mechanical relations of the ether and the atoms immersed in it, is completely justified by experiment. Great differences have been shown to exist among gases as to their power of absorption, and precisely similar differences as regards their power of radiation".

Comparing the absorbing powers of a number of the elementary gases with the like capacity of a number of the compounds of these elements, the Prof. says:

"The elementary gases, hydrogen, oxygen, nitrogen, and the mixture atmospheric air, possess absorptive and radiative powers for radiant heat beyond comparison less than those of the compound gases, Thus we see that hydrogen and nitrogen, when mixed together, produce a small effect, when chemically united to form ammonia (NH_3), produce an enormous effect. Oxygen and hydrogen, when mixed in their electrolytic proportions, show a scarcely sensible action, when chemically combined to form aqueous vapor (OH_2) exert a powerful action. So also with oxygen and nitrogen, which, when mixed, as in our atmosphere, both absorb and radiate feebly, when united to form oscillating systems, as in nitrous oxide (N_2O), have their powers vastly augmented. Pure atmospheric air, of 5 inches mercury pressure, does not effect an absorption equivalent to more than one-fifth of a degree, while nitrous oxide of the same pressure effects an absorption equivalent to fifty-one degrees. Hence the absorption by nitrous oxide at this pressure is about 250 times that of air. No fact in chemistry carries the same conviction to my mind, that air is a mixture and not a compound, than that just cited. In like manner, the absorption by carbonic oxide (CO) of 5 inches pressure is nearly 100 times that of oxygen alone; the absorption by carbonic acid (CO_2), is about 150 times that of oxygen; while the absorption by olefiant gas (C_2H_4), is 1000 times that of its constituent hydrogen. Even the enormous action last mentioned is surpassed by the vapors of many of the volatile liquids, in which the atomic groups are known to attain their highest degree of complexity."

I have supplied the chemical abbreviations in the above quoted passage. It is very plain from the above that absorption and radiation are equal and opposite; the quantity of motion received being the same as that given out. It is also perfectly clear that the combination of the elementary gases hydrogen, oxygen, nitrogen, which absorb very little heat when uncombined, have their capacities greatly increased when combined; in particular if they are combined with more different elements, as carbon or the metals. For example, the absorption of oxygen and hydrogen when combined to form the vapor of water (OH_2), is less than when nitrogen and hydrogen are combined to form ammonia (NH_3). For olefiant gas (C_2H_4), the absorption is still higher, and for a number of the volatile liquids it reaches the highest point. Molecular complexity as a result of the combination of widely different elements, clearly seems to increase the power of absorption for radiant heat. All this must be expected from our mechanical point of view. Prof. Tyndall also took the view that the phenomena of radiation and absorption may be reduced to physical laws. But he did not draw the same conclusions from his experimental results and from physical laws that I have, and this is the more unfortunate for me because, to many it will look like pure presumption on my part to differ with perhaps the most capable and best equipped investigator of modern times. His conclusions are plainly set forth in the following:

"But besides molecular complexity another important consideration remains. All the gases and vapors hitherto mentioned are transparent to light; that is to say, the waves of the visible spectrum pass among them without sensible absorption. Hence it is plain that their absorptive power depends on the periodicity of the undulations which strike them."

As to molecular complexity being a potent factor in absorption, I agree with the Prof. but that absorption is due to periodicity more than to a very small degree, I doubt. He says:

"Now, besides presenting broader sides to the ether, the association of simple atoms to form groups must, as a general rule, render their motions through the ether more sluggish, and tend to bring the periods of oscillation into isochronism with the slow undulations of obscure heat, thus enabling the molecule to absorb more effectually such rays as have been made use of in our experiments."

The above is a correct statement of the truth as I understand it. The grouping of atoms would make a more sluggish molecule, which would tend to vibrate more in harmony with the waves of heat, bnt it is only a tendency. The complete attainment of accord or harmony of vibrations, between the molecule and the heat wave, would make the body transparent to heat and there would be no absorption. It appears that Prof. Tyndall was not wholly satisfied with the view of absorption mentioned above. In his analysis of memoir I, he says:

"One of the speculative notions in this section subsequent experience has caused me to modify. Radiation and absorption are here regarded as the act of the molecule as a whole, whereas I now hold them to be mainly the work of the constituent atoms of the molecule. Experimental reasons for this change of conception will be given subsequenly."

But so far as I can learn from his book he did not give up the idea that synchronism or coincidence in time, is a factor in absorption. Now, from my own conception of the laws of motion as derived from the inertia of matter, the one thing which strikes me as the true explanation of absorption and radiation, and its difference with regard to elements and compounds, is simply this: Absorption and radiation are due, both to the molecule as a whole and to its constituent atoms. As a whole, the combination of a number of atoms would make a molecule more sluggish in proportion to the number of atoms combined and the closeness of their union; whereby the molecule would tend to vibrate as a whole with the waves of heat. This tendency to vibrate as a whole, must, at first, be only partial; thus starting a confused motion of the atoms in the molecule, which internal motion has been absorbed from the waves and which may accumulate up to a certain point, at which it will be communicated to the ether as electricity. The longer waves of heat would be the first to shake up the molecule as a whole, because their length comes nearer to the diameter of the molecule. Since the elementary gases are transparent to light, it seems certain that the shorter ether waves must coincide more closely in length with the diameter of the single atoms; hence the atoms would be more apt to vibrate with the waves of light. It is this accord, or harmony of vibration, between the medium and the atoms, which I would regard as the true physical explanation of transparency in all ponderable bodies. The ether is transparent to all wave lengths simply because its particles are the smallest of all, and so must be able to vibrate in harmony with the shortest and quickest of all wave lengths. This extreme lightness of the ether particle would not interfere with its forming the medium of the longer waves, even those of water.

As mentioned before, all the gases and vapors used in these experiments were transparent to light. As I would suppose, the short vibrations of the visible spectrum are able to pass thru, not only the ether, but the molecule unbroken; so there is little or no absorption. The longer and slower waves of heat (also the more powerful because, including more matter they have more momentum) would tend to throw the molecule as a whole into vibrations, and being composed of atoms differing in mass and in close proximity, a confused relative motion of the atoms follows. Owing to difference of mass these atoms would not have the same periods of vibration, hence their confusion. The combination of a number of atoms differing in mass would certainly make not only a more massive and sluggish molecule, with the tendency to vibrate as a whole, but a more complex molecule, which would tend to break the heat waves into a confused motion of the atoms, resulting in a direct communication of the motion to the ether, followed by the expansion of the ether, difference of pressure from the ether, preservation of the individuality of the molecule, its power of repelling like molecules and attracting unlike molecules and its power of radiation.

Thus we are able to follow the chain of cause and effect from radiant heat, thru molecular absorption and thru every connecting link to molecular radiation. The true explanation of absorption must of course include the true explanation of radiation, for both should be a simple result of molecular form.

All the facts of chemical and physical science known to me clearly enforce the view that the more massive the atom, the molecule or the sensible body, the slower it must vibrate when it receives its due share of the motion of the general medium. The reason of this is very plain for it comes directly from the general law of the communication and diffusion of motion. A given quantity of motion imparted to a given quantity of matter, will result in a certain velocity of the mass of matter. The same quantity of motion imparted to double the quantity of matter, will reduce the velocity to one half, simply because the motion must be communicated to double the quantity of matter. Hence if two atoms are placed side by side in the ether, and if one of the atoms contains double the quantity of matter contained in the other, the larger atom will vibrate once while the small one vibrates twice.

Since this view does not agree with that of Prof. Tyndall, it will be well to give the matter some further attention. He maintains, (and he mentions other well known scientists to justify him) that the power of absorption depends on agreement in length and time of vibrations, between the ether waves and the vibrations of the atoms or the molecules. On page 217 he says regarding transparency and opacity to light or heat:

"To what, then, are we to ascribe the deportment of iodine towards luminous and obscure heat? The difference between both qualities of heat is simply one of period. In the one case the waves which convey the energy are short and of rapid recurrence; in the other case they are long and of slow recurrence; the former are intercepted by the iodine, and the latter are allowed to pass. Why? There can, I think, be only one answer to this question—that the intercepted waves are those whose periods coincide with those of the dissolved iodine. Supposing waves of any period to impinge upon an assemblage of molecules of any other period, it is, I think, physically certain that a tremor of greater or less intensity will be set up among the molecules; but for the motion to accumulate so as to produce sensible absorption, coincidence of period is necessary. Briefly defined, therefore, transparency is synonymous with discord, while opacity is synonymous with accord between the periods of the waves of ether and those of the molecules of the body on which they impinge. The transparency, then, of our solution of iodine to the ultra-red undulations demonstrates the incompetency of its atoms to vibrate in unison with the longer waves."

The above is the most complete statement of Tyndall's theory of molecular absorption that I can find in his work and I do not think we can fail to understand it. A tremor of more or less intensity is admitted in the above, and this, of course, is partial absorption; 'but' he says, 'for the motion to accumulate so as to produce sensible absorption, coincidence of period is necessary.'

It is affirmed of course that this theory will apply to the numerous class of bodies which are transparent to light, but opaque more or less to radiant heat. Water is mentioned as a notable example of this class of bodies. According to Melloni's experiments a film of water one-twentieth of an inch thick is competent to intercept all degrees of heat under incandescence. The transparency of pure water to light, is a well known fact. The same is true of the atmosphere, and in less degree of a number of solids and liquids, as glass, alum, mica, diamond and a number of liquids. The atoms or molecules of all these, according to Prof. Tyndall, are more or less in discord with the waves of the visible spectrum, while they are all more or less in accord with the ultra-red or heat waves of the spectrum. On page 49 he advances the supposition that the waves of light have the power of gliding around the molecules of transparent bodies without disturbimg them but little, while the molecules of such bodies have the power of gliding thru the ether without communicating their motion to it, hence such bodies are not absorbers or radiators of the wave form of motion.

It is well known that the waves of light are projected in straight lines in all directions. Would it be possible to project imaginary straight lines in all directions thru a plate of glass, without touching a single molecule? I think not: our common sense plainly teaches us that opaque bodies cast shadows. It is not easy to understand how the waves of light can glide around the molecules of a body of water and it is more difficult to see how they can dodge here and there among those of glass or diamond, which latter is the hardest substance known. There is certainly far less difficulty in the supposition that the waves of light pass unbroken thru the molecules of water as well as thru the ether which surrounds them, leaving little or no motion behind; while the waves of heat, being longer, slower and more powerful, tend to throw the molecule as a whole into vibrations corresponding in period to those of heat, but not wholly succeeding, the atoms in the molecule are confused in their vibrations to the extent that they differ in mass, hence the wave motion is broken in form, absorbed and changed into electricity.

Taking this view we can understand how water is changed from a solid to a liquid by the absorption of heat, (§37), and even how the absorption of heat converts it into steam; but in this case it seems most likely that the expansive force of steam is due, not to its molecular electric repulsive force, but to the projectile force of the atoms of oxygen and hydrogen which are supposed to be the solid constituents of its molecule. In this case the solid units of both the ether and the water would be free to move as required by the laws of inertia. We can take this view or we can suppose that the molecules of water remain intact while the water plays the part of steam, but the latter view seems the more difficult.

The diamond is transparent to light while it is almost completely impervious to heat. Being the hardest substance known, it seems impossible to avoid the idea that its atoms are in contact, forming a body rigid enough to account for its hardness, yet flexible enough to permit some motion and having its physical pores filled with ether, thus forming a medium of nearly uniform density and internal mobility thru which the short undulations can pass with little obstruction. Mercury, on the contrary, is impenetrable to light while it is a most perfect absorber and radiator of heat. How can we suppose that the atom of mercury, which must be more tham 200 times heavier than the atom of hydrogen, be in accord with the waves of light? It is surely more consistent with our ideas of inertia, to suppose that the atoms of mercury are heavy enough to make the short waves of light rebound as we know they do, while they would be most apt to receive the motion of the longer waves. If we suppose the smallest portion of the body of mercury is a solid atom, strictly obeying the laws of motion and just massive enough to be in accord with the waves of heat, thus vibrating and bumping together with very rare ether between them, then how easy it is to understand why mercury expands in exact proportion to the quantity of motion it receives.

With the habitual caution of the trained scientist, Tyndall does not attempt to describe the actual movements of the atoms in the elements or in the compounds, as might be inferred from mechanical laws, tho he freely admits the general application of such laws. In the following remarkable passage he gives a very complete summary of the unexplained questions involved:

"What are the specific qualities which cause one body to radiate copiously and another feebly? Why, on theoretic grounds, must the equivalence of radiation and absorption exist? Why should a highly diathermanous body, as shown by Mr. Balfour Stewart, be a bad radiator, and an athermanous body a good radiator? How is heat conducted? and what is the strict physical meaning of good conductors and bad conductors? Why, in general, should good conductors be bad radiators, and bad radiators good conductors? These, and other questions, referring to facts more or less established, have still to receive their complete answer. It was less with a hope of furnishing such than of shadowing forth the possibility of uniting these various effects by a common bond, that I submitted the following reflexions to the notice of the Royal Society."

It seems to me that several of these questions, if not all, may be answered at present from our more comprehensive mechanical point of view. The specific or physical form which may cause one body to radiate more than another, is of course the same that would cause one body to absorb more than another and both are due to the internal form of the molecule. As already explained, the combination of atoms differing in mass, would form a molecule in which the atoms could not vibrate in harmony with each other, hence the confusion within the molecule, resulting in absorption and radiation. The equivalence of absorption and radiation is thus a matter of course. Why good conductors are generally bad radiators and bad conductors good radiators, is the same question in other words. The motion absorbed by the molecule is transformed and radiated in some diffused form, as heat or electricity, hence is not conducted thru the body. A good conductor is transparent to the motion, either as waves or in the confused form of heat. A bad conductor is one in which the motion is confused in the molecule (absorption) and transferred to the ether as electricity. In so far as the body is a good absorber it is not a good conductor or not transparent and to the same extent it is a good radiator. The subject of conduction has been considered to some extent in §27 and §31.

It may be that Tyndall was misled in his theorizing by a too close adhesion to Dalton's theory of atoms. According to Dalton, the ultimate chemical unit is a single solid atom. (§36). This form of the units of the elementary gases would unfit them as absorbers of motion when uncombined, and even to a great extent when combined. The following passage (page 49), will make his views on this subject perfectly clear:

"Many chemists, I believe, are disposed to reject the idea of an atom, and to adhere to that of equivalent proportions merely. They figure the act of combination as a kind of interpenetration of one substance by another. But this is a mere masking of the fundamental phenomena. The value of the atomic theory consists in its furnishing the physical explanation of the law of equivalents: assuming the one, the other follows; and assuming the act of chemical union as Dalton figured it, we see that it blends harmoniously with the perfectly independent conception of an ether, and enables us to reduce the phenomena of radiation and absorption to the simplest mechanical principles.'

But the "law of equivalents" (the general fact that every chemical element has but one least combining weight, which is always the same no matter what other element it combines with, and that the combining weight of a compound is always equal to the sum of the weights of the elements which enter into its molecule) is, to my notion, just as much in harmony with the theory that the smallest portion of any element which can enter into combination with another element or compound, is not in all cases a single solid atom, but at least in the case of the non-metallic elements it is a group of smaller atoms. This view does not make the law of equivalents dependent upon a single unchangeable atom, but it does make it dependent on the universal laws of the motion of inert matter; and more than this, it opens the way to an explanation of all the other facts of chemistry. This, tho only a speculaton, appears to me to be the only theoretical road to universal harmony.

It is not known to me that any one else has attempted to continue for further results, the experimental work so ably begun by Prof. Tyndall; but it seems that a very important further step would be to determine whether there is a difference in absorptive power corresponding to the known difference in chemical energy among the elements. Oxygen (16), for example, is a very active chemical agent while nitrogen (14), is remarkably inactive. Accordingly oxygen ought to be a much better absorber and radiator than nitrogen. The following from Prof. Tyndall's "Molecular Physics," plainly shows the great difference in absorptive energy between the gaseous elements and their compounds, but reveals no difference between oxygen and nitrogen.

Air a mixture, $O_1 N_4$.	Absorption per 100,	1
Oxygen, O.		1
Nitrogen, N.		1
Hydrogen, H.		1
Chlorine, Cl.		60
Bromine, Br.		60
Carbonic Oxide, CO.		750
Hydrobromic acid, HBr.		1005
Nitric Oxide, NO.		1590
Nitrous Oxide, N_2O.		1860
Hydrogen Sulphide, H_2S.		2100
Ammonia, NH_3.		5460
Olefiant gas, C_2H_4.		6030
Sulfureous acid, SO_2.		6480

The chemical symbols have been added to the above table. Concerning these results Prof. Tyndall remarks: "Air, oxygen, nitrogen and hydrogen are all set down as equal to unity in the above table. I do not mean thereby to affirm that there are no differences between these gases, but that the most powerful and delicate tests hitherto applied have failed to establish a difference in a satisfactory manner."

From inertia it follows that the ether should be transparent to all wave lengths, simply because its particles are the smallest of all. The atom of hydrogen being the smallest of the atoms, ought to form a medium which should be transparent to all wave lengths except the shortest. Admitting it to be too massive to vibrate in perfect harmony with the shortest waves. (partial discord) we can then understand why the atoms of hydrogen are grouped into molecules. Being too sluggish to vibrate with the shortest waves they tend to get together as required by the law of segregation. (38). The union of atoms is a concentration of motion, hence the atomic energy of impact is greater. The molecule thus formed becomes at once an absorber of motion from the shortest waves, which absorbed motion must be radiated and the ether of course is its medium, hence the expansion, difference of pressure and other results must follow. Tyndall used only radiant heat in his experiments and the results are just what we ought to expect from physical laws. The atoms in the molecules of hydrogen, oxygen and nitrogen, being the smallest and lightest of the atoms, are in partial discord only with the shortest waves, hence they may absorb and radiate enough motion to account for the gaseous form of matter, while they may vibrate with the next longer yet visible waves to account for the transparency of these gases both for light and heat. But when these molecules unite to form the vapor or liquid compounds, they then begin to be sluggish enough to intercept the longer waves, as plainly shown in the above table.

From other sources it seems that we have experimental evidence in support of this conclusion. Prof. S. P. Langley, the astronomer, in his researches on solar radiation and atmospheric absorption, claims to have established the following as fact:

1. "After the passage of the solar rays thru the atmosphere, the maximum of heat in the diffracting spectrum lies near the wave length 0.0006 of a millimeter, and therefore in the orange portion agreeing with the maximum intensity of light. (2), Before its passage thru the atmosphere, the maximum of heat intensity was near the blue. (3), The red and ultra red rays, especially the latter, suffer the least absorpton by the atmosphere, while the blue and ultra blue suffer the most." Smithsonian Report, for 1884.

I have asked a trained scientist to carefully read the above and this is what he said about it: This means in substance, that the elementary gases nitrogen and oxygen, with a small proportion of the compound vapors carbonic acid and water, which compose our atmosphere, do absorb a considerable part of the wave motion from the sun, and that the blue and ultra blue (the visible and shortest waves) suffer the most absorption, while the red and ultra red suffer the least. This is just what we ought to expect from physical laws.

There are other experimental facts which support this theory. Prof. W. R. Grove long ago discovered that a white-hot platnum wire, when plunged into pure hydrogen gas, is instantly chilled to blackness. Prof. G. Magnus of the Berlin Academy, in 1860 commenced a series of experiments to learn something about the conductivity of gases; and he was led to believe that hydrogen conducts heat like a metal. Prof. Tyndall's experiments plainly show that dry air (pure oxygen and hydrogen gas) is a much better conductor or transmitter of heat than moist air. In some cases the absorption of the moisture ladened air was 90 times greater than that of dry air. All this is to be expected if our general theory is true. The hydrogen atom must be the smallest of the atoms hence it should come nearest to the ether as a transmitter of all wave lengths, absorbing only the shortest. The oxygen and nitrogen atoms coming next in size should come next in transparency to all wave lengths but the shortest. But so far I have found nothing to show that oxygen is a better absorber than nitrogen when in the free state. In certain compound vapors, however, its presence seems to sensibly increase the power of absorption, as appears in the following table from Prof. Tyndall's Molecular Physics.

Carbon bisulphide, CS_2, Absorption per 100.	4.7.
Chloroform, $CHCl$,	6.5.
Iodide of methyl, OH_3I,	9.6.
Iodide of ethyl, C_2H_5I,	17.7.
Benzole, C_6H_6,	20.6.
Amylene, C_5H_{10},	27.5.
Alcohol, C_2H_6O,	28.1.
Formic ether, $C_3H_6O_2$,	31.4.
Sulphuric ether, $C_4H_{10}O$,	31.9.
Acetic ether, $C_4H_8O_2$,	34.6.
Boracic ether, $BC_6H_{15}O_3$,	300.

It will be noticed that the absorbing capacity of the vapors named in the above table, increases as the number of elements or equivalents which enter into their molecules is increased, for the first six vapors; thus making it highly probable that capacity is dependent on molecular complexity as due to an increase in the number and variety of the atoms which make up the molecules. Compare the two iodides, both of which contain the same elements but one has five and the other eight equivalents. Beginning with alcohol, there is a new element added which is oxygen, and here notice that there is a very marked increase in the absorption of heat. Compare amylene, whose molecule contains 15 equivalents but no oxygen, with alcohol, whose molecule contains only 9 equivalents but one of which is oxygen. Also notice that all the following ethers possess large capacity and that all of them contain oxygen. By making other comparisons in this table it will be seen that oxygen asserts its presence at every point, which fact is at least in harmony with the superior chemical energy of oxygen.

41. ARTIFICIAL AND NATURAL CLOUDS.— There are certain phenomena of our atmosphere which are not classed as chemical, but which have an interesting bearing on this subject of molecular mechanics, and which may now receive some attention.

Prof. Tyndall in his molecular physics describes certain experiments in which the concentrated electric light, or ordinary sun-light, is made to act upon the volatile vapors of a number of liquid compounds. Exposing these vapors in an exhausted glass tube mounted horizontally, and sending a beam from the electric lamp thru the tube from end to end, a cloud was precipitated in the light and thru its action upon the vapors. A great number of vapors were tried in this way and in every case and with all substances found susceptible to the action of light, the cloud made its appearance by first reflecting the blue or shorter waves, then gradually extending to the longer waves. This is a noteworthy fact in view of our theory. The effect in a particular case is described as follows: "Slowly and gradually upon the condensed beam a cloud was formed, which passed in color from the deepest violet thru blue to whiteness. To this record of my note book the remark is added, connect this blue with the color of the sky."

These clouds were invisible in diffused day light, but in the dark they appeared by the light reflected from the particles com posing them, in some cases gradually and in other cases quite suddenly, and in the manner described. Passing the light, before it entered the tube, thru a red or yellow glass, greatly diminished the effect but did not extinguish it. But when a plate of blue glass was interposed before removing the red or yellow, then on taking away the latter, the effect was immediately and considerably increased; thus showing that the short waves were most effective in producing the clouds. Upon examination the light from these clouds was found to be polarized, and the direction of maximum polarization was at right angles to the illuminating beam. Concerning the cause of the formation of these clouds Prof. Tyndall says: "No phenomena of this kind have, I believe, been hitherto observed. The necessary conditions for their production are, first, that the light should decompose the vapor, and secondly, that one or more of the products of decomposition should be either a solid, or should possess a boiling point so high as to insure its precipitation when set free. For though chemical action might occur, and be even energetic, if the products of decomposition be vaporous and colorless they will remain unseen."

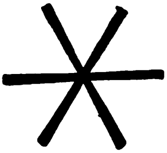
The above is the only reason given for the claim that the decomposition of the vapors is necessary to the formation of the clouds. ;Whether this is true or not it seems to me certain that some form of lose composition or temporary aggregation of molecules, either elementary or compound, (and I suspect most likely the latter) must take place in order to form aggregates massive enough to reflect light as required by the laws of inertia. The fact that the light is polarized and all other observed effects, clearly proves that it is reflected from something formed out of the previously invisible vapor, and which to some extent approaches the state of aggregation which we call condensation or precipitation.

In view of the mechanical theory it seems possible to view these molecules in the act of gathering into lose aggregates, (something like snow flakes but much smaller) under the action of light, somewhat as follows. As shown by these experiments, the most brilliant effects were produced when two dissimilar vapors were mixed in the experimental tube in equal parts. For example the nitrate of amyl and hydrochloric acid, when mixed together, gave rise to a dense cloud which was quickly formed. When either of these vapors were exposed to the light alone, very little effect was observed. In such cases at least, it may be supposed that the light is absorbed more or less by the unlike molecules and converted into the unlike electricities. Attraction would then follow. Whether there is any mutual decomposition might be learned by experiment. But some form of assemblage of the molecules into groups large enough to reflect light is necessary. This action, if not the same, is very similar to chemical affinity; perhaps differing only in the fact that the aggregates are larger than the largest compound molecule. If this is a mechanical action at all, it must be somewhat as described. As to whether decomposition or precipitation first occurs, would perhaps depend on the amount of electric difference between the two compound molecules. If this difference was great enough they might unite and then divide again, either into different compounds or into the original elements; and whatever happened, the products of the action would then gather into flakes large enough to reflect light. If the electric difference is but slight or none at all, there might be little or no sensible effect. The influence of temperature on these results is not mentioned.

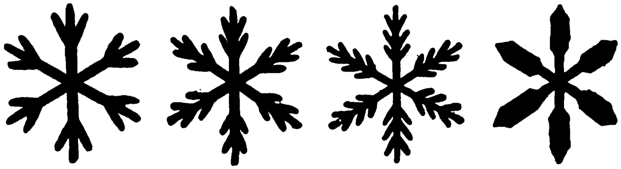
Now the substance which would be most apt to produce similar effects in our atmosphere, and under the action of light and varying temperature, is the vapor of water. The form of the molecule of water, its superior power of absorbing wave motion and acquiring self-repulsion whereby it assumes the vapor form and is diffused thru all the atmosphere, its ability to undergo condensation by loss of motion, in fact all its properties fit it most perfectly for the well known part it plays in our atmosphere. When the receiver of an air pump containing air in which the vapor of water has been diffused, is exhausted, a cloudiness due to the precipitation of the vapor, is produced. In this case the air and vapor is rarefied without increasing molecular motion, and the ether becoming proportionally more dense, the greater quantity of the ether as compared to the air and vapor, would reduce by conduction the radiant motion of the water molecule and so losing a part of their repulsive force would unite mechanically to form particles large enough to reflect light. The shortest waves would no doubt be reflected first but further condensation would reflect the longer waves, hence the white cloud. The ether being more dense and the atmosphere more rare in its upper regions than near the earth, the same conditions as in the air pump would prevail, and so the vapor in that region may be condensed in the same way. The smallest aggregates first formed and just heavy enough to reflect the shortest waves would account for the uniform blue in the upper air where the vapor is most likely uniformly diffused and not very abundant. As the quantity of vapor at different points in the atmosphere was increased, the condensation might reach the point of reflecting the longer waves with the blue thus producing the white cloud. A collection of these white particles would form those delicate fleecy clouds called cirrus, and which we often see floating high in the sky during fine weather. When large volumes of warm air highly charged with moisture ascends into the upper atmosphere, the vapor is condensed to whiteness in the same way thus forming those large white clouds called cumulus. It is worthy of remark that these clouds appear most abundant and extensive at noon in warm weather, but disappear as evening approaches. When lighted up by the sun they present a spectacular display which is well calculated to excite profound attention. These are undoubtedly actinic clouds, that-is, produced by the action of sun-light. The clouds produced in Prof. Tyndall's experimental tube would respond to the slightest touch of the warm hand on the upper side of the tube, by rising toward it. So with the cumulus clouds of our atmosphere; they rise toward the sun thru his power of expanding the air and the ether directly under the sun, thus diminishing the outside pressure of the ether as in the case of the tides (§23). As these clouds settle toward the earth by the weight of their particles, they soon arrive at a warmer region wherein the ether is less dense, and being mingled with more dense air they do not receive the outside pressure they did higher up; hence being more loosely aggregated they cannot reflect as much light as before. A large portion of the light being absorbed as heat or electricity, the cloud takes on its dark, leaden or almost black appearance, as the cloud of storm. These are called the nimbus cloud and they generally precede rain. The particles which form the cirrus and cumulus clouds may disappear entirely by settling down in this way and dissolving into vapor again, instead of being condensed into rain or snow.

In all these changes assumed by the vapor of water in our atmosphere there is no indication that chemical action occurs. In this way it seems that we can follow in imagination the tiny molecule of water in all his skyward flights, from the time he leaves the earth in the ascending column of warm air and vapor, until he returns to earth again as rain or snow. We see them in midsummer as the splendid blue of a clear sky, or again in the high flying cirrus or gorgeous cumuli, and finally they refresh the ground and all life in the welcome shower. But more wonderful than this is the great probability that the governing law in all these changes is the inertia of matter.

42. **Snow Crystals.**— An examination of snow flakes will often reveal in them, small star-shaped crystals from 1-8th to 1-16th of an inch in diameter and formed after a variety of perfectly regular and beautiful patterns. These forms can be seen to good advantage under a microscope or an ordinary magnifying glass when allowed to fall on black cloth cooled below 32° F. They do not appear in every snow-fall, only occasionally, and sometimes very numerous and perfect. It is claimed that these crystals exist in ice, but that their form is lost in the compact mass; but this seems doubtful. The structure of ice is crystalline, but from the theory of the formation of these crystals here described, they must be formed in the upper atmosphere, in a medium less dense than water and under a freezing temperature. It is well known that the most common pattern of these crystals is that of a six-rayed star or figure as shown below:



Of hundreds examined, this will be the fundamental form, tho they may differ in certain parts added to this. Another common feature is, that all the rays of a single crystal will be exactly alike, while those of different crystals may differ widely in the added parts. There is thus a perfect equipoise of structure thruout; for which we will see a reason later. In a few cases when the body of the crystal is large it may have twelve small rays placed as if between the original six. While the majority of the common form have all their rays in one plane, there is occasionally one which sends out rays in a polar direction. But where there is one of these, there will be hundreds of the common six-rayed form, on which the added branches may differ in different crystals, as shown below:

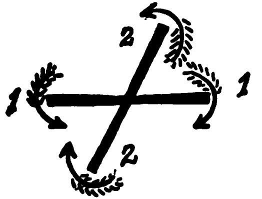


The above drawings are not intended to represent all that others may see in these crystals, only the fundamental plan on which they are generally built. Many of them have other architectural adornments reared on this plan, which, if true as represented in illustrations of them, must be difficult to explain on any physical theory known to me. In this section I will only attempt to apply the mechanical theory as far as it seems to go from present knowledge of the facts.

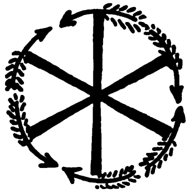
When these crystals are melted together nothing but pure water is the product, and we know that they come from the upper atmosphere when the temperature is at or below freezing. Hence we suppose that they are built up by bringing together the previously scattered molecules of water diffused in the upper air. But how do they get together in such admirable order? Here is a molecular problem which seems to defy the mechanical theory and even to make for intelligent design. Is it possible for the unconscious inertia of matter to do a thing like this? It may be seen at once that this question must be important, because, if the mechanical theory is true to the limit prescribed for it in this book, (§16) we should have in this a most important test for that truth.

The fact that these crystals almost invariably conform to the primary plan of six rays, implies the existence of a law of their formation which is the same for each crystal. If we can discover this law and find it reducible to the general law, the mechanical theory will then receive an important justification. In the first place, these crystals must be formed in the upper atmosphere as above described. Secondly, the temperature of the medium must be reduced to the freezing point of water, 32° F. or more. These are the primary conditions required by the law of inertia, they are the same as required in the condensation of clouds, rain and snow (§41), and they are not only necessary but they are known to exist. When the temperature of the medium is reduced, the molecules will loose some of their independent repulsive force, (which is necessary to maintain the vapor state) hence, they are brought together by outside pressure as in other cases. Now it is mechanically possible that these molecules, in the act of combining to form small particles, may give to the particle a rotary motion as a result of their collisions. A part of this rotary motion would be communicated to the surrounding ether, producing in it a circular current around the equator of the particle while in the act of its first formation. This is very likely the beginning of our crystal, since it will be seen that succeeding steps in the operation which ends in a finished crystal, are not only as simple as this but in perfect harmony with it. To begin with then, we have a small aggregate of molecules of water with a rotary motion and a circular current of ether moving in the same direction around its equator. Now it is evident that molecules floating around outside this small aggregate would be repelled from its equator by this current, but they would be at liberty, in fact compelled, to attach themselves on either pole by outside pressure. It is not difficult to see that this revolving body would communicate from its equator a centrifugal motion to molecules approaching it on that plane, while it would communicate a revolving motion to molecules approaching it from a polar direction. The molecules approaching the poles would whirl in the same direction, hence outside pressure would force them upon each pole, the same as in magnetic attraction (§34). In this way the revolving body would lengthen out in a polar direction while its revolving current of ether would widen out in the same direction thus assuming the form of a cylinder. This cylindrical whirling current of ether, according to this general theory, is an elongated body of electricity which must be divided into two equal parts by outside pressure as in other cases (§23 and §30). This division will occur when the body has reached a length sufficient for the division and for the perfect balance of the two opposite ends. If the body should continue to increase in length, the current most likely would divide again and break away from the original body and so form the nucleus of another crystal. The current being thus divided outside molecules would have a chance to attach themselves to the revolving nucleus at its center between the currents and on opposite sides of it. This would very likely put a check to its revolving motion, besides, the deposit of molecules on two opposite sides of the center would tend to set up other whirling currents on the two sides and at right angles to the first two, or rather the molecules depositing at these points would bring whirling currents with them. This operation would result in building out other rays from the center. Right here a little consideration will disclose the fact that just four rays, on more, can be attached to the center, two on each side and all in the same plane with the first two. This would not only produce a six-rayed crystal but it would permit the only possible harmony of revolving currents.

To be more explicit, the first two currnts must turn the same way because they are formed by the division of the original current. The next two currents formed at the base in the center, would most likely form on opposite sides of the base and in order to be in harmony with each other they would also have to turn one way. But it must be evident that these four rays with their whirling currents could not stand at right angles to each other, for the reason that the direction of the moving currents would be such that the ray on one side of the base would be attracted and would lean toward the one of the first two rays, (marked 1 and 1 in the drawing below) between which and it, the particles of ether would move in the same direction; while the ray on the other side of the base (one of those marked 2) would incline toward the other end of the first two, for the same reason, thus forming a figure like this:



Now in the two remaining gaps on opposite sides of the base, there would be not only just room for two more rays, one in each gap, making six in all, thus:



but it would be impossible to crowd in more than two, or get along with less than two, without spoiling the harmony of the currents. The direction of the currents necessary to secure this harmonious relation, is shown by the arrows in the above cuts.

I have examined these crystals carefully for many winters, but have failed to find any completely formed, in which there was 3, 4, 5, 7, 8, 9, 10 or 11 rays. In the Popular Science Monthly for August 1874 may be found a page of cuts containing 96 different patterns of snow crystals, figured by Captain Scoresby, and among which, with but one exception, there is none having any of the above numbers of rays, while there are 70 having six rays each, 8 having 12 rays and 18 having no rays. These facts, in view of what has been said above seem to indicate the operation of a law in the formation of crystals which may be stated as follows:

1. Snow Crystals are due to the aggregation of the molecules of water, diffused in the upper atmosphere as aqueous vapor, and under a freezing temperature.

2. The first small aggregate acquires a rotary motion in the act of its formation, and so communicates a whirling current to the ether, as described above.

3. Thru the mechanical action of the ether upon these currents, and thru their action upon each other, the six rays of a

normal crystal are built up; and in which action the currents running around opposite rays must turn in the same direction, while currents running around adjacent rays must turn in opposite directions; as indicated by the arrows.

This formula may not answer to all the minute structural details in these crystals, (most of which I have seen only in pictures) but it certainly will apply to all that I have been able to carefully observe, and it seems to me to be about the only view that can be conceived from the mechanical relationship of the ether and the molecules as applied elsewhere. If we imagine a crystal having 3 rays, it is easy to see that adjacent currents would not harmonize all the way around and tho there is one of this number shown in Captain Scoresby's collection, I have not yet found one as a natural product. In a 4 rayed crystal the currents would harmonize all the way around, but opposite currents would have to turn in opposite directions thus spoiling the harmony. In a crystal having either 5, 7, 9, or 11 rays, the result would be the same as in one of 3 rays and in one of 8 rays the result would be the same as in one of 4 rays. But in a six-rayed crystal contiguous or side by side currents would all turn in opposite directions, while opposite currents would turn in the same direction, thus forming the only combination of whirling currents in which there is perfect harmony.

A crystal of 10 rays could have currents all in harmony, but so far I have not found one of this number and it seems highly probable that a 10 rayed crystal could not develop from a first small nucleus because there would not be room for 10 primary currents. I have met with a few 12 rayed crystals, but to which the same objection would apply. But so far it seems that all 12 rayed crystals have well enlarged bodies thus affording a convenient foundation for six extra rays between the original six. But the currents around 12 rays would not harmonize; so it seems that the only way to account for the extras would be to suppose that they are formed after the original six have been dissipated.

But here is something more confirmative. Referring to the lower cut on page 196 it will be seen that the common six-rayed crystal is nearly always supplied with small branches at the ends of the original six. The number of these small branches is always 3, 5 or 7, most often 3 or 5, but very seldom or never 2, 4 or 6. And further, the number of branches in each crystal will be the same for each ray, while these numbers may differ in different crystals. Now, if we mentally compare the number of whirling currents that would be necessary to encircle these branches, it will be seen at once that these numbers of branches are just what would be required to accommodate a harmonious system of whirling currents of ether.

Altogether it seems that we have here the most satisfactory evidence of the existence of an inert medium like the ether, moving in which is the molecules composed of solid inert atoms as described. We must have the atoms in whirling groups and to keep them going they must have inertia, and to keep them together we must have the ether with its difference of pressure. The whirl of the bunch of atoms must be communicated to the ether hence the whirling currents of ether. The fact that just six whirling currents can be matched in complete harmony, resulting in the six-rayed figure as described, is highly suggestive. So far as it goes this theory is the same molecular electro-mechanical theory applied in the three preceeding chapters and altogether they certainly bring us close to the insensible activities of the molecules and the ether.

43. MODERN VIEWS OF THE ETHER AND OF ELECTRICITY.— In October 1911, while setting the type for page 200 of this book I noticed in the Denver Public Library a copy of "Modern Views of Electricity". (second edition) by Oliver J. Lodge, Professer of Physics in University College, Liverpool. I remember seeing a notice of this book somewhere, but I made no effort to get a copy and I am sorry because it seems to be a very complete exposition of the most recent advances, by the best known specialists on this subject. The language of modern science is not always lucid to my mentality, and what I say about this book may not do it justice; but I will be careful and make the best effort I can after a hasty reading.

In his preface Prof. Lodge says: "The doctrine expounded in this book is the ethereal theory of electricity. Crudely one may say that as heat is a form of energy or a mode of motion, so electricity is a form of ether, or a mode of ethereal manifestation. ** A rough and crude statement adapted for popular use is that electricity and ether are identical; but that is not all, for there are two opposite kinds of electricity, and there are not two ethers. ** they may be two aspects ** two components of the ether. ** Anything which can be sheared (and ether is sheared by every electromotive force applied to it) must consist of two parts sufficiently different to travel or to be displaced in opposite directions."

The meaning of the word 'sheared' as applied to the ether in the above passage is not quite clear to me. If taken in the ordinary sense it would mean that the electromotive force is a sort of cutting instrument which divides the ether into its two supposed components. When I first read the above I thought it might be some new scientific way of referring to my idea of ether expansion, and I felt some alarm; but I have found no indication in this book that they have got on to this yet, tho at once. Neither can the two be the same in quantity. In my view positive and negative simply means more or less expansion of the ether. Two bodies charged equally always repel each other. (§30). The following simple experiment will make this plain. Cut two strips from an ordinary newspaper about six inches wide and eighteen inches long, lay them on the bare table, one on top of the other and hold the ends of both between thumb and finger of left hand. Rub the top strip briskly two or three strokes with right hand and lift the strips both from the table and notice that they attract each other; which shows that the top strip is positive and the bottom negative. To prove this hold both strips close to the wall of the room and notice that the top strip attracts the wall much stronger than the other does. Now place the strips again on the table as before and rub them both, first one side then the other, by turning them over quickly, then hold them up; they repel each other. This shows that both strips are positive and equal. To prove it, hold both strips to the wall and see both attract the wall equally. The table and the wall are conductors; that is the ether in them is more expanded than in the air. But their ether is negative to that of the strips of paper when excited by friction. When the top strip is rubbed its positive ether exerts pressure outwards against the medium and the medium reacts inwards against the positive and negative ether in the two fields, hence the two fields tend to unite and as a result we have the electric current or electric attraction (§30 and §31).

Since the above was set up, I have found a copy of a third edition (1907) of this book, in which the statements and page numbers have been changed somewhat; also new matter added.

Page 11. "Electricity always, under all circumstances, flows in a closed circuit, the same quantity crossing every section of that circuit, so that it is not possible to exhaust it from one region of space and condense it in another."

If electricity is an incompressible inexpansible substance filling all space in the universe, the above statement is undoubtedly true; but if electricity is nothing but motion in a compressible expansible ether medium filling all space in the universe not occupied by the atoms and having empty space between its particles, then the above statement is not true. Two expanded fields in the ether, positive and negative, will flow into each other thru a conductor. As this motion of expansion and a portion of the ether is transported thru the conductor, the extra motion(E. M. F.) is gradually communicated to the surrounding medium while the ether is gradually condensed in and around the conductor, thus forcing back to the neighborhoods of the expanded fields, not the same but the equivalent of the motion and the ether which was transported thru the conductor. But this is not a closed circuit in the sense used above. The E. M. F. or motion which is communicated to the ether in the positive field is not returned to that field again thru some round about course. It is simply rushed into the negative field and diffused in the surrounding medium.

Page 14. From this view regarding closed circuits and for other reasons, it is believed that electricity "behaves like a perfectly incompressible substance or fluid, of which all space is completely full. * * Not a simple fluid, but a fluid in a violent state of spin—a vortex-sponge, as it has been called—is what the ether is going to turn out to be. * * But as this conception is difficult at present, we can vaguely say that ether contains electricity as a jelly contains water; and that the rigidity concerned in its transverse vibrations belongs, not to the water in the jelly, but to the way in which it is entangled in its meshes.'

The above will perhaps be sufficient to convey some idea of this incompressible all including all penetrating fluid like electricity. This theory, which has been elaborated by a number of eminent scientists, is now believed to be the most promising one, for it seems to be regarded as capable of affording an explanation for matter itself; and hence all the mysteries of the physical universe. The atoms according to this view would be inconceivably small vortices in the ether, and their combinations and separations would account for all the rest; that is when the theory has been worked to the end. But returning to electricity; it seems to me that the facts do not show that it behaves like an incompressible fluid. Every one knows that a room can be warmed on a cold day by having a good fire in the stove. When the room is hot there is more motion in it than there is in the air of an equal space outside. So with electricity and the ether. If we put to work a powerful electric machine in a room full of cold dry air, we will soon have more electricity in that room than in an equal space outside. In the case of heat, by forcing in the motion we crowd out the air. In the case of electricity, by forcing in the motion we crowd out the ether. Just as the air is expansible and compressible, so the ether is. The fact that electricity is always found on, or just within, the surface of conductors, and at their ends, is readily explained under our theory of difference of pressure The more dense outside ether pushes in or resists the expanded field, while the more dense ponderable matter within pushes out or resists the expanded field on its inside; hence the field takes the only place and only form between two opposing forces. For the same reason the electricity of the sun is confined to its hot lower atmosphere, that of the earth to its surface and lower atmosphere, that of a metal sphere to its surface, that of a cylinder to its ends and that of a magnet to its ends.

Page 87. The question whether electricity has inertia or momentum is considered. Experiment shows that a current cannot be started instantaneously; it takes time, tho generally a very short time. And when started, it takes time to stop it, as appears by the spark on breaking the circuit. This we should expect if the electric current is a moving inert substance. But we could hardly expect a current of expanded ether flowing thru a long slender wire with a weaker current flowing in the opposite direction, to have much effect. A sensible body of it moving with great velocity must have some effect and undoubtedly it is a moving body of inert matter when shot out from an electrified cloud as in a flash of lightning; tho in such cases the atoms may be mingled with the ether thereby increasing its momentum. The inertia of the ether may be confined for the most part to its individual particles, which are supposed to move with the greatest possible velocity (§19 §20). From this point of view it follows that a sensible body of the ether must have a sensible momentum if it moves fast enough; but the sensible motion of such a body may be very slow when compared to the motion of its particles. It is mentioned that a coil of wire carrying a steady current does not maintain itself in a fixed plane like a top or a gyroscope. But how is it in the case of whirling currents of ether around the rays of snow crystals? (§42). Here we have a case of six currents, all independent in their motion (tho dependent in their origin and in their relations) and each maintaining its own plane of revolution. Is it not the gyrostatic action in this case which keeps the rays of each crystal all in one plane? Each ray pointing in one direction all must have the same plane and the whole comes under Newton's first law of motion (§16).

Page 90. Electricity does not flow thru a conducting wire like water thru a pipe. It plainly shows a disturbing effect in the medium on all sides of the conductor. This action in all its described forms appears to me to agree perfectly with the idea of an ether medium, and of two differently expanded fields in it, which tend to flow into each other, as a result of the outside pressure of the medium at all points on the two fields and on the conductor between them. If electricity was a substance like a fluid or a gas, how could it flow thru other fluids or gases the way it does without a pipe to keep it from mixing with the others? Certainly in this respect it does not behave like a fluid. As expanded ether under pressure on all sides but the one, it can move only in that direction of least resistance; which of course is thru the conductor containing negative ether. A current like this it seems, might effect the medium on all sides in the several ways described. But why does a conducting circuit tend to enlarge itself so as to inclose the greatest possible area? Is it because the longer conductor affords more radiating surface? All the facts plainly show that something is communicated to the medium from all points on the conductor.

Page 92. It is supposed that the molecules of the dielectric medium are inseparably connected with electricity, and move with it, and so it is supposed that electricity itself has no inertia, that the inertia of the molecules gives it that appearance. According to my view every molecule of a gas or a fluid is surrounded by an atmosphere of expanded ether (electricity) on which their mutual repulsion and the gaseous and fluid form of matter depende. Very likely the molecules of the medium move with the current in some cases, as those of a strong discharge, and being more massive, their superior inertia would assert itself more than that of the ether (§38).

Page 94. It is said that the power which urges forward the electric current thru the conductor is not applied at its end, but at all points along its length and that we must distinguish between the flow of electricity and the flow of electric energy. This is the discovery of Maxwell and Poynting, and in my view there is some truth in it, but the true distinction is between simple matter and motion, not between a mysterious electricity and a mysterious energy. As I see it the power is applied at the end and at all points along the circuit, but the initiation of the power must be at the end. When motion is communicated directly from ponderable matter to the ether it must be applied at one point, hence the positive field. Connect this with a conductor which affords sufficient radiating surface, and which may or may not lead back to the positive field, and the circuit is complete. The positive field exerts pressure outwards against the surrounding medium. The medium exerts pressure not only on the positive field but at every point on the negative field thru the length of the conductor. The two electricities poeitive and negative, are thus squeezed into each other by the pressure of the medium at all points. Like young people in their courtships, the squeezing is necessary to bring them together.

Page 106. The voltaic battery is explained by assuming an unexplained chemical attraction between the atoms of different substances. Hydrogen and oxygen in the free state are supposed to be charged opposite, the former positive and the latter negative. This holds them loosely together in the molecule of water. If in a vessel of water is placed a strip of copper and a strip of zinc, the metals will attract the atoms in the water, a separation follows and the atoms find new partners among the metallic brethren. Now it comes to pass that zinc and copper both like oxygen, but zinc proves to be the successful wooer and the copper gets left. But like a good copper he does the next best thing and takes a mate from the hydrogen family and all is well for a while. The atoms give up their electricity to the metals and soon the metals have got enough and they refuse to take any more; so the procedure stops. But if the two metals are connected by a wire, then their electricities run together and everything goes merrily on; hence the voltaic circuit.

This theory is interesting because it shows the tendency of the modern scientific mind. It is now freely admitted that the atoms may be charged with positive and negative electricity, and that they may attract and repel each other; and it is also admitted that the questions, how the atoms get their electricity, how they attract and repel and what electricity is, in itself, are still wanting an answer? (§33).

Page 117. To explain the origin of the thermo-electric current it is supposed that the moving atoms in the heated ends of the bars of metal have a to and fro vibration, moving fast in one direction and coming back slow, thus giving the electricity a hunch as it were, to make it hike for the cold end of the bars of metal. Two bars of dissimilar metals joined together in the usual way, and driving currents in opposite directions, would account for the thermo circuit. But this theory was abandoned later and I am glad it was. If the atoms were in the habit of behaving like this it might be very difficult to explain how they do it. There is a passage here which I ought to quote because it is suggestive of something more than appears on the surface. "Whenever conduction is going on along a substance the atoms are moving unsymmetrically. They are driven forward infinitesimally quicker by the more rapidly moving atoms at the hot end, than they are driven back by the less rapidly moving atoms in front. And whatever the cause may be, such a slope of temperature exerts a propulsive tendency; there is an electro-motive force in a substance unequally heated".

This passage, like many others in this book, describes an effect which reveals in unmistakable clearness that relationship of heat and electricity which proves that the one changes into the other. If heat is a mode of motion, and if heat can change into electricity, then what is electricity? From whence comes the electro-motive force in this case if not from the heat in the metals, communicated directly to the ether in the metals, thus expanding it and hence the current in the only direction of no resistance; thru the circuit? Now which is the most in harmony with established laws of motion; this view, or the view of an unsymmetrical atomic motion, that is, vibrations which alternate between slow and fast? (§34).

But here is a question from my point of view. Why does the current in the thermo pair travel around thru the wire and not direct from one metal to the other? Is it because the wire affords a greater radiating surface for the diffusion of motion?

There is reason to believe that the current travels both ways. It is known that the mere contact of two unlik bodies, when not heated or connected by a wire, will start a feeble current. What would be the result if we take two bars of unlike metals, connect both ends by conducting wires, then heat them? Would the positive current travel one way around the circuit, or would it travel both ways, thru both wires, from the positive metal? If my view is right it would travel both ways.

Page 119. This means of generating a current is not confined to metals; it is possible with non-conductors and it has been called the contact force. It is supposed to be the source of frictional electricity. The rubbing together of two dissimilar bodies secures a rapid succession of contacts; hence the current.

According to my view frictional electricity is made to appear and is explained by supposing that the unlike molecules in two dissimilar non-conductors, when rubbed together, impart to the ether unlike degrees of expansion; and so becoming related as positive and negative there is an interchange between them; hence the current (§29 and 30).

Page 123. The passage of electricity thru gases is considered. Gases and vapors may be divided into two classes; those which conduct electricity and those which do not. Those which conduct, do so electrolytically; that is, by the movement of electrified molecules, and it is supposed that the gases are decomposed and their atoms reformed into little things called ions; and so the gas or vapor is said to be ionised. It is not explained what the ions are. Non-conducting gases and vapors are perfect insulators until a passage has been forced thru them by disruptive discharge. The density of a gas under pressure, effects its conducting capacity; the more dense the better it will conduct.

According to my view (§32) the molecules of a gas or a vapor may be singly and rapidly charged with expanded ether and immediately repelled outward, like a comet from the sun, being succeeded by others, thus projecting a stream which reaches the negative field. Outside pressure or resistance from the medium would keep such molecules in line and the line might extend several inches thru the gas or vapor.

Page 131. It is recognized that a coiled wire conveying a current of electricity will behave exactly like a permanent magnet. Ampere's theory that megnetism is whirling currente of electricity around the molecules of the magnet, is accepted as true. The act of magnetizing a bar of iron or steel consists in setting the axis of rotation of these revolving currents all in one direction, and this is done by the application of a permanent magnet or a coil of wire conveying a current of electricity. All this seems to be in perfect harmony with the mechanical theory; with the exception that it is not quite clear to me how the currents in the magnet are arranged so as to be in harmony with each other. Prof. Lodge has devised a system of geared wheels to explain the harmony of such currents, and this may be their true relation. He has even applied his wheel system to the electric current to show how the two currents may slide past each other; but in this case it seems to me unnecessary. If we think of exceedingly fine streams of ether particles flowing or shooting in opposite directions thru the conductor, this is all that seems necessary. But why is it that a magnet and a coiled wire do not behave toward each other the same as two magnets or two coils? There is an action between them but it is neither attraction nor repulsion. If either one is fixed, the other revolves around it; and why? The only reason that I can think of is this: According to my view the whirling currents of ether in the magnet are the only really closed circuits. In them there are not two currents flowing in opposite directions; only one in one direction and the motive force is the inertia of the current alone. Between two such currents the attraction and repulsion ought to be stronger than between two currents of ether in coiled wires. Now between a magnet and a coil, we would have one current on the magnet side facing two currents on the coil side, one of which is moving in the opposite direction. If we can suppose that the repulsion due to the opposite currents is sufficient to neutralize the attraction due to the currents in the same direction, then the two bodies would neither attract nor repel, but might tend to rotate around each other as observed. But I am not sure of this. My opportunities for experiment or study of the literature of the subject have not been very good. There are many things in this book about electricity that I never heard of before. On the whole it shows a wonderful amount of close observation and research, and no doubt it is one of the best.

Now what I say here about "Modern Views of Electricity," is not said with any desire to find unreasonable fault with the foremost promoters of exact science. But if I allow myself the liberty of speech which all men claim as their own, and if I state plainly what I have been led to think from reading this book, I will have to say that many of the ideas or theories offered here are conspicuously contrary to the most ordinary common sense. The numerous facts are no doubt scientifically presented so far as science goes, but the reasoning upon the facts, or the speculative parts of the work, are often remarkably antagonistic to the common judgment of men. It would be impossible for me to convey these ideas in my own words and feel sure that I have them right for I am not sure that I understand them. I must quote a passage or two, as little as possible, and judge them the best I can from my point of view. Regarding the structure of the ether it is stated:

Page 319. "The material universe seems to consist of a perfectly continuous incompressible and inextensible medium, filling all space without interstices or breaks of continuity;— not of a molecular or discrete structure, and as a whole completely at rest: as frictionless moreover, and unresisting to all ordinary motion of what we call matter through it, as is the mathematical conception—a perfect fluid. But in spite of immobility as a whole, it possesses that 'rigidity' or elastic resilience to 'shear' which is characteristic of what we ordinarily call a solid; wherefore it would appear that it must be, throughout, in such a state of fine grained turbulent motion as would confer this property upon it. And the recilience is so complete and instantaneous, without any delay or permanent set, that elasticity must be described as 'perfect'. It is the gyrostatic kind of elasticity, discovered dynamically and applied ethereally by Lord Kelvin, whereby a perfect fluid can acquire some of the properties of a perfect solid."

The first part of the above is clear to me if it means that the material universe seems to be a perfectly continuous incompressible, inextensible (or perhaps inexpansible, indilatable or indiffusable) medium, filling all space, without breaks of continuity or interstices unoccupied, not atomic or molecular or of a discrete structure, and as a whole completely at rest; yet unresisting to the motion of what we call ordinary matter; — a mathematically perfect fluid. If it means this, I understand it perfectly, and this is exactly what I would call an absolute solid. A continuous medium is a continuous body of matter; no space within its limits unoccupied. If it consists of parts or particles, they must be packed so close together that no space between them can be empty. But such a body cannot be thought of as even having parts. It must be one continuous mass thruout; and this is nothing less than an absolute solid. If there can be any doubt as to this not being the correct meaning of the first part of the above passage, the following will dispel that doubt.

Page 410. "When I say that matter is certainly atomic, I do not mean that ether is atomic. I hold that ether is most certainly not atomic—not discontinuous; it is an absolutely continuous medium, without breaks or gaps or space of any kind in it, the universal connector; permeating not only the rest of space, as I have just said, but permeating also the space occupied by the atoms themselves. The atom is a something superposed upon, not substituted for, the ether; it is most likely a definite modification of the ether, an individualization with a permanent existence and a faculty of locomotion which the ether alone does not possess."

There is just one and only one construction to be put upon the above words and no one can fail to understand it. And it is suggested as most likely that ordinary matter is a form of the ether itself. Here a host of questions arise, and they are hard ones too. How can the ether assume the many forms, and go thru the many changes which we observe in ordinary matter, if it is a continuous medium or an absolute solid as described? How can we think of the Kelvin vortices, the magnetic whirls, the electric currents, the multitude of chemical changes, the endless forms and movements of sensible objects or how can we think at all in such a body of matter? What is that property of rigidity or elastic recilience to shear, which is supposed to be a characteristic of an ordinary solid and which belongs to the ether? How can we think of a state of excessive fine grained turbulent motion as would confer the property of elasticity to a continuous medium? What is the gyrostatic kind of elasticity discovered and proved mathematically by Lord Kelvin, and how does it work in a continuous medium? Is it possible for a continuous compact body of matter, substantially as described, to possess any conceivable form of elasticity? No. Think of an ordinary elastic solid moving and striking against an absolute solid. What would be the effect on the latter? If it was too big to receive motion as a whole there would be no effect. The moving body would rebound by its own elasticity and all of its own motion except a small part which is absorbed and occupied in the act of resilience. As I understand it, elasticity is possible with all ponderable bodies which are composed of atoms and molecules, which are not packed so close together as to fill all the space between them. The physical pores in the solid, afford room for the molecules to move more or less upon each other, thus permitting the body to yield more or less to external pressure or impact. Now the property of resilience, springiness or elasticity, simply consists in the fact that the internal molecular framework can spring back to its former shape. This of course would be impossible in an absolute solid simply because there would be no room among the molecules for any amount of displacement or reaction. With vapors and gases the physical cause of elasticity is somewhat different. The molecules are not in semi-rigid contact but are kept at regular intervals apart by mutual repulsion, and in some cases, as those of super-expansion, the motion and impact of free atoms may play a part in the expansive force or elasticity of the gas or vapor, But in regard to the ether, we surely must not persist in harboring that monstrosity called a 'continuous medium' and which modern science is now flaunting to the world. What excuse have they got for offering it? so utterly contrary to reason and common sense. If there is even a flimsy argument in its favor I have never seen it. Perhaps it is the best they can offer and they do not believe it themselves. When we can accept sea-serpents a mile long, and flying horses, and centaurs, and hydras and such like, then we are mentally fixed to believe that we and all the other things are living and moving within an absolute solid.

Now let us think of an atomic or not continuous medium of ordinary inert matter. These atoms or particles are absolute solids, perfectly indestructible and infinitesimally small; perhaps the smallest that can exist. They may be so close together that millions of them can occupy a space immeasurably small, but we cannot expect them to be packed so close as to fill all the space, for then, every atom and everything else, would be bound in the embrace of an absolute solid, or next thing to it, and relative motion would be impossible. So we must have them distributed in space at regular intervals apart, and the space between them must be empty, and to keep them apart we cannot assume that they repel each other like the molecules, for then, for obvious reasons, it would be impossible to explain this repulsive force. Here we are facing a concept which I believe is worth our while to consider. These atoms or particles of inert matter, may perform the part of ultimate units, of a perfect physical medium, which, under established laws of motion as applied to ordinary matter, will do all that the most exacting science can demand of the ether, if we simply admit that they have motion. Only this to begin with; then every succeeding step to a complete solution of every physical fact known to science is as easy as chewing gum.

These atoms can never lose their motion because they move in empty space, strike together and rebound, always receiving as much motion as they give. The only way to deprive them of motion would be to crowd them so close together that they could not move, and under the law of the diffusion of motion, this, if it could happen at all, must occur in parts of the medium so remote from radiating ponderable bodies as to give the motion the distance, thru which to travel, necessary to its complete diffusion. But as will appear at the end of chapter seventh this is unlikely. These atoms have nothing to do but vibrate and bump together, and they never go on a strike. They can move slow or fast according to the quantity of motion they receive from radiating centers. When they go fast the medium is more rare, when they go slow it is more dense. We can see how motion may be communicated directly to this medium in at least five different ways; heat, chemical action, friction, magnetism and waves in all lengths. But waves may arise from heat or chemical action, in short all are forms of the one thing motion. The idea of expansion, and difference of expansion, comes in right here as indispensable. As a means of accounting for the two electricities positive and negative, it is just the thing. I remember well, it was about the year 1877 that this matter of the real cause and wherefore of the two electricities, occupied me a great deal, and every line of speculation that I could follow at all, led me straight to this idea of expansion in a medium of ether as described. The extreme elasticity or springiness of volume, of such a medium, its extreme mobility and penetrating power, the fact that all ponderable bodies down to the smallest atom can move thru it, its perfection as a medium for wave motion, the necessary part it plays in chemistry, electricity, gravity, and as we shall see in the next chapter, in astronomy, all this, it seems to me, comes directly and inevitably from the idea of an inert atomic medium as described. (§19 and 20) ·

This I would call the common sense view of the ether. Now let the trained scientist get industrious with his figure-pad and pencil and show us why it is not true. But most likely not all of the leaders in modern science have believed in a continuous medium. Appleton's Annual for 1881 contains an account of late theories of electricity in which there is no indication that the writers believed in a continuous medium. These accounts were copied, and the subjoined comments written, in the year following and they were printed in the first small edition of this book (1895). They ought to have gone into this book at the end of chapter fifth but I left them out because I was afraid this book already contained too many quotations. I will insert them here.

Prof. James C. Maxwell has proposed a theory of electricity described as follows.— "The ground for this theory is the explanation which the two states of electric energy, static and dynamic, afford of the vibratory motion of light. Electricity when passing through conductors, or revolving within the poles of a magnet, is a dynamic force; and when dammed, backed by an insulator, is a static force existing in a state of strain. Light is a form of energy which alternates between the dynamic and static forms. Its rapid motion through a transparent medium is only comparable to the rate at which electricity travels through a conductor. That the only known physical forces whose effects are transmitted through such wide media and at such a high rate of motion, should possess precisely the same velocity, proves that the phenomena can only be referred to the same source. It is stated that there are certain phenomena which. while showing an intimate connection between light and electricity, have not yet been explained in accordance with Maxwell's theory. One of these is the remarkable effect of light in reducing the electric resistance of selenium, the light of a candle being sufficient to enhance its conducting power five-fold. Another is the fact that light generates a current on striking the platinum electrode of a voltameter."

The following was written in 1882 or '83, in reply to the above quoted passage.—

[This theory if I rightly understand the account of it, is in harmony with mechanical principles as far as it goes. The expanding part of an ether wave would be a dynamic force, something like a discharge of electricity, but the condensed part would hardly represent our idea of static electricity, or expanded ether confined in an unchanging place, surrounded by more dense ether. The close resemblance in rate of motion between light and an electric wave thru a conductor has long been recognized, and it is consistent with laws of motion to suppose that they are propagated in the same manner. The theory however, does not include our mechanical conception of difference of density and pressure in the medium, due to radiation, which is necessary to explain attraction and repulsion. Neither does it comprehend the molecular difference in the various bodies as a source of the difference in density of the ether in them, which is necessary in order to explain their differenc in conducting capacity. In fact, so far as I know, it does not attempt to apply the laws of inertia to the phenomena of light and electricity. The effect of light in enhancing the conducting power of selenium, or in generating a current in platinum, would be simply to impart molecular activity, which would increase the electric difference between selenium as a conductor and some source of electricity, and between platinum as a source and some conductor. This theory no doubt aims in the direction of the truth, and it shows the tendency of the minds of our best thinkers.]

To the above comment I will add, that it does not appear certain from the above quoted passage, what the two states of electric energy, static and dynamic, are supposed to be. Hence a comparison of them to the theory of wave motion described in §27, would be impossible. The effect of light in increasing the conducting power of selenium, should simply consist in an increase in the molecular motion and ether expansion, making it a direction of less resistance to some nearby expanded field of ether opposite to its own. It seems clear that Maxwell held to the view that electricity is a form of motion, or at least a form of energy; but perhaps he was undesided as to what energy is.

Prof. S. P. Thompson and others have originated a theory of electricity which makes it a kind of matter, or a third entity, matter and energy being first and second entities.—

"Experiments appear to show that electricity in its relation to matter and energy, acts only as a transmitter of energy, and is not convertible into it. The quantity of electricity in a closed surface, it has been demonstrated, cannot be increased or diminished without the entrance or outflow of electricity. It is concluded then, that electricity is a third entity, distinct from matter and energy, the total quantity of which in the universe is conceived to be constant, as is the total quantity of matter and energy. It resembles matter in that it requires the expenditure of energy to set it in motion, and when its motion is arrested the energy appears again as an equivalent of light, heat, or some other form. * * Electricity may be imagined to be a physical entity which does not possess mass, but yet possesses a quality corresponding to electricity, and can be the recipient of energy in both the kinetic and potential forms; and which tends to distribute itself equally throughout space, and exercise a definite pressure on those ultimate particles of matter which it does not penetrate. Under this supposition electricity would fulfill all the functions which are ascribed to the intersteller and intermolecular ether. The hypothesis of the imponderable ether of space may be abandoned in favor of the immaterial electricity which may be assumed to fill all space. Light would then be the vibrations of this elastic imponderable medium."

The following comment on the above was written in 1882. [This theory, like the other, is a move in the right direction so far as it admits the close relationship of the ether and electricity; as, for instance, the ether or electricity acts as the transmitter of motion, and is not convertible into it; also the quantity of ether in a closed place cannot be increased or diminished without the inflow or outflow of ether; and further, that it resembles matter inasmuch that it requires the expenditure of motion to set it in motion, and when its motion is arrested it appears in its equivalent of some other form of motion, as light, heat, sound or sensible motion; and again, that it can be the recipient of motion in both the kinetic and potential forms. But like the other it comes short of any fundamental law which unites electricity with all the universe; besides, it makes no attempt to explain a host of facts of electricity, such as its relations to conductors and non-conductors, and the nature of its power of attraction and repulsion. The conclusion that electricity is a third entity. distinct from matter and energy, involves difficulties, since it is impossible to think of more than one kind of matter. The laws of thought permit us to have only physical ideas of matter, and these include nothing but forms, relations and changes. Even if different kinds of matter did exist we could not know them. The only consistent idea of electricity is, that it is a class of forms of motion, light, heat, sound etc., being other forms of the same motion.]

From the above quoted passages it seems that Maxwell was disposed to regard electricity as a form of energy, while Thompson supposed it to be a kind of matter; a physical entity which does not possess mass, yet which may be the recipient of energy or motion, and Prof. Lodge thinks it may be a form of matter but it is not a form of energy. The words 'energy' and 'motion' are used by all of these writers in a way which indicates that no clear distinction has ever been made, between the two, and this is to be expected, since it is admitted everywhere that science does not claim to know what energy or even motion is.

The following from Prof. John Tyndall's life of Faraday is more explicit as to what electricity is, than any statement I have met with yet. While considering the resistance in the magnetic field, and its power of starting currents of electricity in a wire he says.—

"When the wire approaches the magnet, an action is evoked in it, which travels through it with a velocity comparable to that of light. One substance only in the universe has been hitherto proved competent to transmit power at this velocity; the luminiferous ether. Not only its rapidity of progression but its ability to produce the motion of light and heat, indicates that the electric current is also motion. Further, there is a striking resemblance between the action of good and bad conductors as regards electricity, and the action of diathermanous and adiathermanous bodies as regards radiant heat. The good conductor is diathermanous to the electric current; it allows free transmission without the development of heat. The bad conductor is adiathermanous to the electric current, and hence the passage of the latter is accompanied by the development of heat. I am strongly inclined to hold the electric current, pure and simple, to be a motion of the ether alone; good conductors being so constituted that the motion may be propagated through their ether without sensible transfer to their atoms, while in the case of bad conductors this transfer is effected, the transferred motion appearing as heat."

In a foot note Prof. Tyndall mentions Maxwell as being engaged in similar lines of investigation and he speaks of him in the following highly complementary words.—

"Even in the non-mathematical portions of the memoirs of Mr. Maxwell, the admirable spirit of his philosophy is sufficiently revealed. As regards the employment of scientific imagery, I hardly know his equal in power of conception and clearness of definition."

We might use exactly the same words in referring to the mode of thought and expression of Tyndall himself. I know of no scientific writer who has excelled him in this respect. He also mentions Faraday as entertaining similar views regarding the relations of light, heat, electricity and ordinary motion.—

"I do not know whether Faraday would have subscribed to what is here written; probably his habitual caution would have prevented him from committing himself to anything so definite. But some such idea filled his mind and colored his language through all the latter years of his life."

Faraday, Maxwell and Tyndall belonged to an age of science less modern than the present, and they have now gone to the world of greater mystery. I am inclined to think that these three men will be remembered with higher regard by future science, than many of the leaders of the present day, and I am rather proud of the fact that the following comment on the first passage above, quoted from Tyndall's "Faraday as a Discoverer," was written more than 30 years ago.

[Such expressions as the above, coming from the most independent and careful thinkers of the present age, shows us the tendency of the scientific mind. Tyndall's advanced and sound ideas regarding the nature of heat and light are well known to the public, and they are briefly but clearly expressed in the above passage where he says: "Not only its rapidity of progression, but its ability to produce the motion of light and heat indicates that the electric current is also motion." If physical science admits the proposition that light, heat, sound or any form of energy is motion, it must admit the proposition that all forms of energy are motion; for to think of motion changing into anything which is not motion is impossible. A ray of light starting from our sun continues its course thru the ether for thousands of years, until completely transformed. If we ask why the motion thus continues after taking the form of light, the only answer that can be given is, that it travels thru a medium of inert matter. If electricity is a motion of the ether alone, then it persists for the same reason that light or any motion persists; and the governing law is the same for all; simple inertia.]

44. METEOROLOGY.— If this earth was alone in the universe, no outside body closer than the nearest fixed star, and if its own surface was perfectly uniform as regards temperature, distribution of land, water and atmosphere, then from the inertia of matter as it applies to all parts of the universe, it may be inferred that all the phenomena or changes in our atmosphere, with their dependent results, would be entirely absent and the science of meteorology would have no business on this planet. The edd and flow of the tides in the ocean being a result of the radiations of the moon and the sun (§23), a similar movement may occur in the earth's atmosphere as due to the same cause. As in the case of the tides the expansion of the air would result from the electric radiation of the moon and the sun, which expands the ether above the air thus reducing its outside pressure on the earth at that point. Not only the ocean and the air would be expanded in this way, but the mercury of the barometer as well as all other fluids and gases should undergo some degree of expansion. Experiment has shown that when the moon is on the meridian at the equator the barometer is higher by 6-1000th of an inch, than it is when the moon is six

hours from the meridian. In such cases if the expansion of the mercury can be measured in a column 28 inches in length, it ought to show a greater lengthening in a longer column, while a column of air 50 miles in hight ought to show a much greater elevation. So it appears that our atmosphere may be expanded in two ways, (1), by heat as in any increase of its temperature, and (2), by electric radiation, which expands the ether above the atmosphere, thus diminishing outside pressure and permitting it to expand by its internal motion. It is evident that the barometer would indicate any decrease in the pressure of the air as due to a rise of temperature, but would it indicate a decrease of pressure as due to the electric radiation alone?

It is known that the air always contains the vapor of water and that its capacity for taking up this vapor increases with its temperature. It is also known that water soon evaporates when placed in the receiver of an air pump and the air above it is exhausted by removing a portion of it, thus thinning it, and relieving the pressure of the air on the water. By thus increasing the rarity of the air, the moisture it contains may be condensed into clouds or even rain. So it is highly probable that the capacity of the earth's atmosphere for receiving and precipitating moisture, may be influenced by the electric radiation of the moon, the sun and even the planets. Such influence is known to be a result of the radiation of heat, but whether any one has been able to prove that there is an electric influence, is not known to me.

It seems possible to designate all the mechanical agencies, even to the most minute and obscure, which take part in producing the great variety of meteorological changes which are constantly going on in our atmosphere. Principal among these may be mentioned; the earth's annual or yearly motion around the sun; its daily revolution on its axis and the inclination of the axis to the ecliptic, (which gives the changes of the seasons and the alternations of day and night; the irregular distribution of land and water on the surface of the earth, (which gives direction and change of direction to the currents of air; the distribution of mountains, plains and forest land; the variations in the moon's motion and distance, also the sun, and the changing distance and position of the planets with reference to the position of the sun and the earth, etc. In this intricate series constantly at work, we have to look for all the causes and all the explanations of all the changes of the weather, and difference of climate in different parts of the world. Principal among these are the storms of rain, snow, sleet, hail, wind storms, hurricanes or cyclones, dew, frost, fog, clouds etc, and the different forms of climate, as cold, hot, mild, dry, moist etc.

Now in order to calculate the exact time of occurrence of a particular storm period, weeks or months in advance, it seems very plain from the above, that it would be necessary to take into account a great number of connected but exceeding complicated and obscure quantities; every one of which takes a necessary part in the mechanical series which leads to the result at a particular time, but many of which cannot be measured or even known. When we make a correct estimate in figures we must know at the start that each number that enters in, represents a definite quantity. An illustration of the difficulties in such an attempt may be had in the following experiment.—

Go to the top of a hill with a long steep incline, select a heavy round stone and let it roll to the foot of the hill. The stone is an irregular mass, yet round enough to roll down hill and the side of the hill presents many small inequalities, no two alike and none so great as to stop the stone. At the end of a certain time the stone will stop at a certain point on the level. This much can be predicted in advance, and in the same way the so called weather prophet can risk a guess as to whether a storm will occur at a certain time. It is impossible to know in advance the exact point at which the stone will stop; so it is impossible to learn in advance the exact time at which a storm will begin. To prove the extreme complexity of the operation let the same stone roll down the same place several times from the same point and notice that it will never stop twice on the same spot.

This is the problem which must always confront the student of meteorology, as inferred from physical laws. The impelling and counteracting forces which determine the exact time and place of a coming storm, are too numerous and involved in obscurity to be traced out by the mind of physical man; at least a week or a month in advance with the same certainty that the astronomer is now able to calculate the time of beginning, ending and all the phases of an eclipse or the transit of a planet. It is nevertheless possible to give warning of the approach of a storm which is already in progress; and for this purpose the weather bureau is a valuable adjunct to the public service. But the weather prophet who claims to be able to give the dates of an unusual storm a month in advance, and who declines to show how he does it, most likely has nothing better than guess work and whoes random shots may hit the mark sometimes.

[NOTE. My review of the late book on electricity in §43, of this chapter, ought to have gone in at the end of chapter 5, as it seems to break the line of the subject of this chapter; which, beginning with the relations of the ether, the atoms and the molecules, as we find them first in chemistry, then in artificial and natural clouds, snow crystals and meteorology, thus leading up to the universe as a whole which is the subject of the next chapter. But electricity and ether are subject of the discussion.]

CHAPTER SEVENTH.

THE PHYSICAL HEAVENS.

45. A GENERAL VIEW OF THE UNIVERSE.— A clear sky at midnight with no moonlight or sound to divert the thought, is an inspiring picture which has no comparison. Long ago when there was no science of astronomy to give instruction about the heavens, there was wonder and veneration in the minds of men, for this great expance of night with its countless stars, which hangs in silence over all the earth. What would be the aspect of this great firmament if there was no stars or moon? We can imagine a black and formless void, adding a hundred fold to the darkness of the earth and making of our nights a most suitable time for ghosts and devils to stalk forth in all their diabolical dignity; certainly not a cheerful prospect. The ancients could look upon the heavens and speculate as to the secrets of nature hidden there, but little did they think of the profound truths which modern astronomy was destined to reveal. And of all the revelations of this modern science there is nothing more wonderful than the truth of the inconceivable immensity of the universe. A few comparisons will make this clear.

This earth on which we live is a globe so large that we are not casually sensible of the rotundity of its surface, and if we could walk around it once it would be a tramp of 25 thousand. miles. Any one who has walked a mile and who has some idea of the difference between a mile and a hundred or a thousand or ten thousand miles, can perhaps arrive at some conception of the size of the earth. A comparison of the volume of the earth to some of the other members of our system will carry us still further in this direction. The volume of Jupiter, the largest of our system, is 1, 400 times that of the earth. But the earth and even the monster Jupiter are paled into insignificance when compared to our sun, a white hot globe 1,400,000 times the volume of the earth. In view of these facts what must we think of the vast intervals of space within our solar system, and which astronomers have been able to measure. For example, the diameter of the orbit of the outmost planet of our system measures 5,724 millionsof miles. This enormous circle, the orbit of the planet Neptune, represents the diameter of our Solar System. Now if we go outside this limit, and give the widest range to the imagination in that vast region which contains the unnumbered millions of stars, then perhaps we can begin to realize how it is possible that our sun with all his planets is comparatively a mere point of light like a star in the great domain of God.

Astronomers have succeeded in estimating the distance to a few of the nearest stars, and in referring to these immense intervals, the smallest units of distance are expressed in millions. For instance the distance to the nearest star is said to be 20 millions of millions of miles. This is the bright star in the constellation Centaur, which has been named Alpha, after the first letter in the Greek alphabet. The star 61 in the Swan is the next nearest, and the distance to this star is more than double that of the first. It has been found convenient to express the intervals of space between the nearest stars and our earth, by the time it takes a ray of light to travel from the star to us. Thus the light from the nearest star requires three years and eight months to reach us and light travels at the rate of 186,000 miles per second. From 61 in the Swan, light makes the journey in 7 1-4 years; from Vega in Lyra, 21 years; from Sirius in the Great Dog, the star well known to be the brightest in the heavens, 22 years; from Alpha the bright star in Cannus Major or the Big Dipper 25 years; from Arcturus in Bootes, 26 years and from Auriga 72 years.

These stars are the principal ones among the few that are near enough to have their distance computed by the means now accessible. They are also among the brightest and they are distributed in all directions from us. It is believed that the light of the most remote stars visible to us thru the largest telescopes requires over 15 millions of years to reach this small planet. Suppose that one of our astronomers with his big telescope was transported to one of those most distant visible stars, and set down easy on one of its planets and permitted to look beyond in the same direction. What would he see? Perhaps nothing but another equally great expanse of star spangled space, limited like the present by the limits of vision; and we might assume that the universe has no limits. But it would not be a sane conclusion to assume that a thing does not exist simpyl because we cannot see it.

All the stars visible to us on succeeding nights during the entire year, are supposed to belong to one great cluster called the Sidereal System. By the labors of Sir William Herschel, R. A. Proctor and others, the form of this cluster has been to some extent traced out, and it appaers to have the shape of a 'gigantic spiral' or disk, its width being much greater than its polar thickness. Our sun with his litter of young planets and moons occupys a place near the center and in a region which contains comparatively few stars. When we look at the great arch of nebulous light which crosses the heavens and which we call the Milky Way, we are looking into the greatest depths of the Sidereal System. When the telescope is pointed in this direction, that which appears to the naked eye as an undefined cloud, is at once resolved into millions of stars apparently so close together as to be hardly distinguishable, and beyond which is more cloudy matter. Every increase in telescopic power has enabled observers to penetrate deeper into this self uminous mass of matter, revealing clouds after clouds, each in turn being resolved into stars, and tho in some directions something like a limit to the clusters appears, in other directions there are no signs of a limit. Mr Proctor was of the opinion that the outlines and form of the Sidereal System is not so well defined as formerly supposed; that it is most likely a complicated spiral shaped cluster of clusters of small stars, having out-lying arms or branches which extend beyond the highest power of the telescope. Also, that it contains vast bodies of true nebulae associated with its stars, and that it is connected with distant nebulae and star clusters.

All the visible stars have been classified according to their relative brightness, called magnitudes; which implies nothing as to their relative volume but may indicate something as to their distance; the nearest being the brightest. There are 20 stars of the first magnitude (brightest); 34 of the second; 141 of the third; 327 of the fourth; 959 of the fifth; 4424 of the sixth, making in all 5905 visible to the unaided sight. By the use of the telescope the classification has been extended to the ninth magnitude; including about 200,000 stars in the different orders of brightness. Beyond this they have not been classified with precision, but thru the best telescope the visible stars have been roughly estimated as numbering over 20 millions. With every increase in telescopic power the number of stars have been increased and the field of view proportionally widened.

Among the interesting objects of the heavens, there is the double and multiple stars. Before Sir W. Herschel commenced his work only four double stars were known, but he succeeded in increasing the number to more than five hundred, and later observers have made it six thousand. In some cases the two in a double are of equal brightness, but it more often happens that one is brighter than the other, and sometimes the brilliancy of one is so much greater than the other as to almost completely obliterate it; thus showing the possibility of a difference of temperature. It is a noteworthy fact that in many cases one of these stars revolves around the other, showing that they are physically connected as the planets of our system are connected with the sun. Of this number, 358 have been carefully examine and their physical connection is considered not doubtful; and there are 554 whose connection in this way is believed to be less certain. There are also a number of stars having two, three, four and even five attendants; and these for the most part have been proved to be connected by a center of gravity exactly as the planets of our system are connected. When the distance of these star systems from our planetary system is known, it is claimed to be possible to compute the diameter of the orbits of these secondary stars. For example the attendant which delongs to Alpha in Centaur is situated from its center of gravity about 4-5 ths of the distance of our planet Uranus from the sun. Also when the relation between the dimensions of the orbit and the time of revolution of the attendant, is known, it is claimed to be possible to determine the mass of both the central body and its attendant. The star 61 in the Swan has been found by this means to contain about 1-3 the amount of matter in our sun. No 70 Ophiuchus also has a companion, and the mass of this star is three times that of our sun. Lately it has been discovered that Sirius has a small companion, and it has been learned that the mass of this well known star is 13.7 times that of our sun.

It therefore appears certain that the stars do differ in mass or quantity of matter; some far exceeding our sun, while others are doubtless much smaller. It is also known that they differ in temperature, in color and in other physical conditions. But these are only physical differences which are readily accounted for under physical laws. In many respects they resemble our sun so closely that the theory of the same physical origin for all, is to me, not doubtful. The light and heat of all of them has been generated in the same mechanical way, to be described later. The same mechanical gravity that rules in our Solar System is applicable to these multiple star systems. In fact it seems most certain that they differ from our sun and planets only in the fact that their planets are still highly heated and self luminous like the stars generally, thus making themselves visible to us.

From the evidence that the planets of our system, including this earth, were at some time in the remote past highly heated and self luminous like the sun, and that they have cooled down to their present temperature during succeeding ages, we cannot fail to see the close resemblance between these distant systems and our own. That our sun like his neighboring stars was once attended by smaller stars, which have since cooled off and come to be planets, one of which we know to be inhabited, and that in the slow march of physical changes these remote secondary suns will also cool off long before their primaries and become planets, possibly inhabitable like this earth, is certainly a high probability. It must be also probable that at least the greater part of the principal stars of the universe have planets attending them, and that owing to their great distance from our planet we can see only the nearest, and of these only those which are still hot enough to shine by their own light. The brilliant

Sirius has one small self luminous planet, but what would prevent him having two or three, or even half a dozen non-luminous planets which we cannot see, and which may be cool enough to support life? It was not long ago that our big planet Jupiter was hot enough to shine like a star, and it may be that the astronomers of some far off world have already placed on record the probability that our sun is a double star.

If the number of stars which we can see thru the best telescope, may be counted by the millions, what must be the number of planets which may accompany these stars? If our sun, not one of the largest, can support eight planets, with their nineteen satellites, besides the 209 asteroids or very small planets, then the planets may even outnumber the stars. As shown by the spectroscope, the composition of the stars is much the same as our sun and planets; so we have the strong probability that there is but one substance for all worlds and all life, and that our sun, of which our own bodies was once a part, is also a star like the others, only one of a congregation so great that it may be forever impossible to count them.

And this is the Kingdom of God; if not, where is it?

46. GRAVITY AMONG THE STARS.— From the preceding section it appears that the mechanical theory of gravity will apply to the binery star systems scattered thruout the heavens. Now we will see how it works in its application to the universe as a whole, or as far as known to us.

As already mentioned (§22), the law of the action of the force of gravity as demonstrated by Newton, does not conflict with the mechanical theory, when confined to the relative mass of the planets and their distance from their common center of gravity, when that center is maintained at a constant temperature. But Newton's definition of the force seems to be at fault when it includes the mass of the central body without regard to its temperature. It is also wrong when it assumes that every particle of matter in the universe attracts every other particle, at all times and thru all distances. If the physical theory represents the truth there is nothing in gravity but mechanical ether pressure due to the motion of inert matter as described (§20), and this is not what is meant by the word attraction. Suppose for arguments sake, that this theory of attraction is true; let us look briefly at the consequence.

As required by its definition, the force of gravity which collects ponderable matter into large masses like the sun and stars, must have been active in all the past and thru all space within the universe. The planets of our system and those of all other systems, as well as all ponderable bodies large or small, should have ere this been united with some center of aggregation This process could not have gone on forever. If it had a beginning it would have an ending, and the end would be in the final collection of all such matter into these centers, and for these centers the inevitable fate of darkness, silence and death would await them in the radiaton of all their molecular motion into the medium, save that which may come from outside bodies in the form of waves. The next mechanical possibility would be the collision of these dead suns. When two such bodies come together, which they most certainly would in time; their collision would change their mass motion into heat, light and electricity, converting them into a fiery vapor or nebula. But after ages of slow radiation and condensation the two dodies would form one, larger than before but still a burned out sun. Each particle in this mass would have to exert and obey this mutual attraction, and the only other action possible for it would be its motion in a straight line. That these two forces, attraction and motion, are not equal and opposite, and that attraction must eventually put an end to all motion, is plainly self evident. If a system of planets were formed in the condensation of such a mass, the end of condensation would find them all united with their common center, and this center might be free to move in any direction, and exercise its power of attraction upon other centers, but nothing more. Eventually it would unite with others and after the same routine was thru, it would reach the same state as before, and its mass would be considerably increased. This process going on at a great number of widely separated points at the same time, it must follow that in the course of immense ages the number of such bodies would gradually grow less while the quantity of matter in each would increase. Hence the certainty of the final roundup would be only a question of time and time has no limit.

In the meantime the repeated collisions of these bodies and the friction of the medium during condensation, would tend to diminish their motion, both mass and molecular, so that when the final concentration of all ponderable matter into one great mass took place, which it undoubtedly would in time, the amount of motion available for the rediffusion of this matter would be almost nothing against the tremendous force of attraction which, according to its definition, would be called into action by the concentration of so much matter. So it seems that we can safely conclude that the theory that every particle of matter in the universe attracts every other particle, as defined, is not true; for if it was, this universe, in view of a past eternity in which matter and motion was not created out of nothing, ought to be dead and cold right now.

The idea that matter can exercise force without moving, is so out of harmony with all common sense thinking that no one but an unfortunate with an over-educated brain can entertain it, and it was emphatically condemned by Newton himself. But if we take the simple view that the power which manipulates the heavenly bodies is a direct result of the motion of inert matter, in fact, nothing in itself but such motion, as already described, then this difficulty and others to be noticed not only disappear, but as has been shown in other chapters we are able to explain and harmonize the mysteries of astronomy, physics and chemistry under the same general law. This physical agent is here supposed to handle the stars, planets, moons, comets nebula etc, in the same way that it handles the pith balls in our electric experiments or the molecules in chemical changes (§38). For example, two stars of the same temperature or physically alike, will repel each other for the same reason that two pith balls charged by the same form of electricity, either positive or negative, will repel each other. Or to take an example in chemistry, two molecules of water or of any liquid or gas, mutually repel for the same reason that two stars or two pith balls will repel. In the case of attraction, a star and a planet, or two stars differing in temperature, or two planets or a planet and its satelite, between which there is a difference of temperature, will attract each other for the same reason that two pith balls, one charged positive and the other negative will attract each other. Or as in chemistry, for the same reason that two molecules of different substances which have an affinity for each other, will attract and combine as already explained. Or to state the theory in the language of mechanics, a physical difference in the atoms and molecules of ponderable bodies, as due to their difference in mass and quantity of motion, will impart different degrees of expansion in the surrounding ether. When there is physical likeness between two such bodies of expanded ether, there is always repulsion; when there is a certain degree of physical difference between two such bodies there is attraction. This applies to all aggregates of ponderable matter from the smallest molecule to the largest star, and the process is mechanical thruout; and we shall now see that it plays a very important part in the relative activities of the heavenly bodies.

Over 5000 nebula and star clusters have been observed in all parts of the heavens and their places are indicated in star maps and catalogues. The most of theses have been carefully examined by means of the spectroscope, and about one third of the number exhibit a spectrum consisting of a few disconnected bright lines which indicate certain well known gases. The rest show a continuous spectrum like that of our sun and the fixed stars. It is believed that these facts prove the former to be extensive bodies of incandescent gas or true nebula, and the latter to be extensive clusters of small stars very close together. Some of these clusters are visible to the naked eye. In the constellation Hercules there is one which, on a clear night may be seen as a hazy looking spot, and when viewed in a good telescope, its appearence has been described in such words as 'grand beyond description.' No doubt is entertained but that these clusters contain a great number of separate stars so close together as to be hardly distinguishable. The well known Pleiades contains six small stars visible to the eye and faint glimpses of many more. In a telescope of medium power 188 may be counted The luminous spot in Cancer, when viewed thru a telescope is completely resolved into stars, and there is another similar bunch in the sword-handle of Perseus. In the southern sky may be found a number of such star clusters far exceeding these in extent and number of stars.

Now it is generally believed, and with good reason, that the stars in these clusters are close enough together to have a strong attraction for each other, and being grouped together as they are, the inference from Newton's theory of attraction is irresistible, that they must promptly unite to form one great mass. But since, to all appearance, they are not doing this, the inference is equally certain that the theory of attraction is not true. It has been supposed that the stars in these groups are kept apart by a rotary motion of the whole around a common center like the planets of our system. But we have no planets in a polar direction from our sun and the reason is very plain as inferred from physical laws. Since some of these clusters appear to have the form of a sphere, what would prevent the stars in a polar direction from uniting in the center? Besides, the great extent and irregularity of form of many of these clusters precludes the possibility of them being kept apart by a rotary motion around a common center; and no other mechanical agency seems to me possible.

But the theory of mechanical electricity described in preceding chapters, appears to me to be deficient in nŏ respect, as a means of accounting for all the forms of these star groups as well as the fact that they are kept apart. And best of all, it is the same mechanical theory which accounts for everything on the physical side of the universe. The stars in these groups are kept apart, not necessrially by a rotary motion, but by the fact that they have a uniform or nearly uniform temperature, so that each one is charged by the same electricity or expanded ether, hence they repel each other just as the molecules of a gas or a liquid, or the electrified pith balls do.

This theory being a part of the universal theory should of-course help us to account for the origin of these star clusters by simply supposing that they were condensed from the original nebula by the usual process of cooling similar to that which produced our solar system but without the rotary motion.

It seems impossible to look at the pictures of distant nebula and star clusters, and read the accounts of them by careful observers, and not be strongly impressed with the truth of the mechanical relations of the ether and ponderable matter as described. Some of these bodies show all the irregularities of form which we see in the clouds of our atmosphere, which are purely mechanical in their origin. They also assume forms which would be impossible in our clouds of aqueous vapor, showing that most likely they are composed of heavier material. Some of them have assumed the spiral form with curved branches around a common center, very clearly indicating their possible origin in the colision of large masses. Others have the form of rings like those of our planet Saturn, but with little or no matter in the center, and in one case there are two rings one inside the other. From their borders extend branches in all directions, obeying no law of formation but that of the motion of inert matter. In all these bodies there is the one striking fact; the separation of their parts by the ether as described, and which alone seems entirely sufficient to account for all their different shapes as well as the fact that they are self-luminous.

47. **The Universal Cycle.**— In view of the facts and legitimate inferrences so far adduced, and in view of a beginningless and endless eternity in the past and future, and of the fact that the universe is not dead, but full of life and energy, it is very plain that there must exist in the very nature of the conditions of existence, a great endless cycle of physical changes thru which ponderable matter is continually passing.

From the laws described in the first three chapters of this book it follows that a series of physical changes which continue forever without once repeating itself, is, in no sense to be entertained. Matter is everywhere in motion and always changing from old to new forms, its longest course being run always brings it around to a new and similar course in which the same old substance appears again in new form, and so on forever. A series of changes which is most general and extended in time, being inevitable, we are now to inquire as to its nature.

We see on every hand an immense number of centers of aggregation for ponderable matter. The sun and all the stars are engaged in this business and even the planets, their satellites and the comets are fitted for the work of gathering up smaller and colder bodies. As shown in other places it is only a physical likeness which prevents two bodies from uniting, while a physical difference will bring them together if they are not kept apart as are the planets of our system. But even this, as shown elswhere, cannot be regarded as permanent; so the accumulation of ponderable matter into larger centers must now be going on in all parts of the universe. Since this process does not end in a dead universe, it must end in some process of redistribution, which separates the components of these large bodies, returning the matter to some form from which it may proceed again thru a similar series of physical changes. We will now attempt to trace out this endless round of changes and see if it comes under the general physical law so far applied. The one which seems to me to be most in harmony with the facts naturally divides itself into three parts described in the three following sections.

48. THE BIRTH AND LIFE OF PLANETARY SYSTEMS.— The nebula theory of the origin of our solar system, proposed by Kant, Laplace and Herschel, has been universally accepted, so far as I can learn, because it accounts for all the facts so far as it goes. This theory applies to all other planet or star systems, the same as to our own, and being an indispensable part of the universal theory here described, a brief account of it will be given as follows.

It is supposed, to begin with, that all the matter contained in our solar system, was, at some time in the remote past, in a state of vapor or gas, intensely hot and greatly diffused in space so as to extend beyond the orbit of the outmost planet, and that it had a revolving motion from west to east. Let us remember that this nebula, heated, diffused and turning on its axis, is necessary to the beginning of the mechanical process which is the only means of transforming its material into a system of planets like the one we inhabit. Or in other words, this particular form of the body of matter and its motion, from which the system is evolved, is absolutely necessary to the beginning of the mechanical series which produces the system. The nebula theory begins with this form of nebula, but so far as I know it does not attempt to account for the nebula.

From the rotary motion of this nebula it follows that its form must have been oval or perhaps double convex, for the reason that the centrifugal force resulting from its rotary motion would prevent the condensation of its material around the equator, but would not prevent its contraction on either pole; hence the oval form. This revolving mass being surrounded by a conducting medium would gradually cool off by radiating its motion (heat, light, electricity,) into this medium. As it cooled it would gradually contract in volume under the outside pressure of the medium. With this condensation there would be a slight increase in the rotary motion, and as a result the centrifugal force of that portion of the body which is outside and directly over the equator would reach a balance, or rather would maintain a balance with outside pressure, hence would not contract further toward the center. As the main body continued to contract, it would shrink away from this outside portion, and so a nebulous ring would be formed around the equator of the revolving body. This process being continued, a number of rings within rings would be formed, finally leaving a portion of the material in the center, which gives gravitating stability to the system and light and heat to the planets which are formed by the further condensation of the rings.

These nebulous rings would continue to give up their molecular motion to the medium and shrink in volume; hence they would either break up into small bodies, or the ring would part at one side,—which parting would most likely occur at the thinnest point and perhaps on the side toward which the system is moving if it has a proper motion in some equatorial direction. In either case, whether a ring of small bodies or a crescent shaped body should result, it is evident that one portion would be more dense or greater in volume than the rest, and that the lighter or thinner portion would gravitate toward the more dense portion. In this case all that portion behind the point of greatest density would have its centrifugal force augmented with reference to the sun, while all that portion in advance of the most dense part would have its centrifugal force retarded. So it will be seen that while the ring is forming into one body around the largest portion, all that part which is dehind this largest portion will fall for the most part on the outside, away from the sun, while all the material in advance will fall on the inside; and as a result the body when completely formed will have a rotary motion from west to east the same as the sun.

In this way, not only the planets, but their common rotary motion from west to east is accounted for; with the exception of the two outmost planets whose direction of rotation is not certainly known but supposed to be retrograde; that is, in the opposite direction, since their satellites are known to move in the opposite direction. The orbits of the satellites of Uranus have an inclination of 79° to the plane of the ecliptic; henc it is possible that the retrograde motion of these outmost planets might have resulted from some outside influence, such as the precipitation of a large mass upon the planet from the outside, and whose line of approach was of the direction necessary to give rise to the present inclination of the orbits of the satellites, as well as their retrograde motion. So far the part of this theory which aims to account for the rotary motion of the planets, and the direction of motion of their satellites, is a speculation of my own; all the rest is from the literature of the subject.

The planets formed in this way would still retain the nebulous and highly heated form, and in all respects except in volume and in the fact that they move in orbits around a larger central mass, they would resemble the original nebula. After some further condensation they would shine by their own light like the sun and the fixed stars, and would of course be visible at a great distance. The fact that just such star systems can now be seen by the hundreds in all directions, is highly favorable to a general mechanical theory. In the course of time these nebulous planets would cool and contract as the original nebula did and this cooling process would proceed more rapidly because of their reduced volume. Rings would be produced as with the planets and these would finally form moons just as we find them with the Earth, Mars, Jupiter, Saturn, Uranus and Neptune. But in the case of our moon and those of Jupiter, no rotary motion has resulted from condensation, as with the planets. This and the fact that these bodies have no atmosphere, has been explained in (§24).

The nebula theory as above described, all but the part added, has been accepted without hesitation by all astronomers. It is not incongruent with a single known fact and science does not furnish a better explanation of a large number of well known facts nor a better example of the successful application of theory. The fact that all the planets, ninety in number including the minor planets, revolve one way and in one plane around the sun's equator; the fact that the sun turns on his axis in the same direction; the fact that the planets on the whole increase in density as they are less distant from the sun; the fact that all the major planets and their satellites have orbits of small eccentricity; the fact that all the satellites so far as known revolve around their primaries in the same direction in which the latter turn on their axis, and the evidence of a highly heated condition of the earth at some time in the distant past obtained thru a study of the earth's crust, all these facts and others of less importance have been completely accounted for by the nebular theory, leaving it only necessary for us to find the true place of this theory in the most general theory.

Now let us remember that this entire process from the original nebula to the present form of the system of planets etc, is conducted thruout in exact harmony with the law of inertia, and that, so far as it goes it agrees with the theories of gravity, electricity, chemistry and others already described. Any theory therefore, which aims to account for the possible future of this system of planets, must conform to this theory. As for the future of our world, all that can be said at present is, that it will continue very much as it is for an immense length of time, but its final dissolution seems to be asured for reasons to be described in the following section and which are offered as simply a further application of the same mechanical laws,

49. THE DISSOLUTION OF PLANETARY SYSTEMS.— The most tenable theory yet proposed to account for the maintainance of the present high temperature of our sun, is that originated by Dr. R. J. Mayer. Prof. H. L. F. Helmholtz and others, and which assumes the mechanical impact of ponderable bodies, impelled into the sun by the force of gravity; also a slow process of condensation continually active in the sun as a result of radiation and the same force of gravity. There is much evidence that the space betwen the stars and our sun contains numerous bodies of matter which range in size from the meteors which occasionally fall on the earth to bodies like the largest comet, and even larger, and that such bodies may, and often do, fall into the sun. Prof. Helmholtz has shown however, that the rate of the sun's radiation during historic times cannot be wholly accounted for by the fall of outside matter; but that the slow condensation of its volume is sufficient, according to mechanical law, to account for its enormous expenditure of energy during that time. This of course is the same process of condensation due to radiation and gravity, which has been going on since the beginning of the original nebula from which the system was formed. And so it is evident that this process of condensation and radiation is still going on. The sun's present density has been estimated to be less than a fourth of the mean density of the earth; hence it has been assumed as highly probable that, at the present rate of condensation the high temperature of the sun ought to continue as it is for at least 17 millions of years to come. With this prospect in view the peoples of this planet may have time to become thoroughly humanized before quitting, if they can be made to understand the need of further progress.

A small mass of heated matter when isolated will cool faster than a large mass at the same temperature. The age of a planetary system therefore, will depend to a considerable extent upon the mass and temperature of its central sun. A system like that of the star Sirius ought to live much longer than our system because its central mass is more than a dozen times as great as that of our sun. It is of course possible that the heat and light of our sun, or that of any of the others, may be renewed from time to time by the precipitation upon them of unknown bodies of matter which are still wandering about in space, but are not known because they have cooled below the point of emitting light. But it is a plain inference that since this space is continually being cleared of such bodies, the time will surely come when the renewals from such sources will be less than the expenditure by radiation; hence the final cooling of the system is only a matter of time. From Newton's theory of attraction it has been inferred that the force of gravity and the friction of the medium will eventually bring all the planets into the sun, from which there is no resurrection.

But from the present general theory it is far more probable, in fact as certain as certainty can be predicted from any theory, that our sun and all the principle stars, are now and have been from the time of their birth, active agents in clearing space of loose fragments of ponderable matter; and that this process, sooner or later, must end in a clean sweep of all this space. It is a noteworthy fact in this connection, that the nebula are not uniformly distribted in space; but are abundant in the polar regions of the Sidereal System where stars are few, and rare in the vicinity of its plane where stars are numerous. This of course means that the stars are active centers of aggregation for nebulous matter. An intensely heated mass is a source of difference of pressure in the ether, hence the accumulation of outside matter in the stars, as required by the mechanical theory of gravity.

The sun and stars being thus active from the time of their birth in clearing space of ponderable matter, a stage in the process will be reached at which the incoming motion will be less than that of radiation. At this point such centers will begin to grow cold and contract in volume. Since a large body may get just as cold as a small one if it has time to cool off, it follows that all the members of our system including the sun, will arrive at an even temperature; and this will be far more frigid than that within the arctic circle. At this stage and in view of the mechanieal theory of gravity, the separation of the members of our system and its final dissolution, will be assured in two ways.—(1), by electric repulsion due to an equalization of temperature, or (2), the centrifugal force due to their motion around the sun, which motion, not being dissipated by radiation or friction would persist to the end. But more likely the planets and their satellites, one by one would separate from the central mass as a result of their centrifugal force before the system has cooled sufficient to admit of repulsion. The rotary motion of the planets and the sun, in particular the latter, might also give rise to a dissipation of these bodies to some extent. Whatever happened, the end of radiation would come in time, and with it the dissipation of internal motion to the point of uniform diffusion, and finally the certainty of the breaking up of the system and the scattering of its parts in all directions in its equatorial plane. Each separate part would pursue its own course thru the universe in a straight line as required by the first law of motion.

This I would call the mechanical dissolution of planetary systems. It will be seen that this process is not only conducted thruout in perfect accord with the laws of inertia, but it agrees perfectly with all the minor theories so far described. And as we proceed further its universal application will become more and more apparent until we reach the end.

50. **The Origin of Planetary Nebula.**— Here I shall use the words 'planetary nebula' to mean all nebula which, owing to their original formation, are capable of being developed into planetary systems; and in this section I will try to describe the manner of their formation.

There is no evidence that the great collection of stars called the Sidereal System has a revolving motion around a common center of gravity; but it has been found that many of the stars, and possibly all, are moving in different directions and with different velocities. Not only most of the bright stars are moving, but our sun and all our planets are moving as one mass. As estimated by Struve the motion of our system amounts to 150 millions of miles annually, and we are moving toward the constellation Hercules. As a result of this general movement the constellation figures are gradually changing in form; and which change in the last 2000 years is plainly sensible to the eye. The motion of Arcturus during this time has amounted to more than one degree and that of Procyon and Sirius to three quarters of a degree. It also appears that some of the stars are moving toward us while others are moving away from us.

It thus appears that the stars of this greatest known cluster have an irregular motion in all directions with different velocities, and in which motion there is no discoverable uniformity which would imply their mechanical connection like the planets of our system. What is true of the self-luminous bodies in this respect may be equally true of the opaque bodies which are invisible and which might result from the dissolution of planetary systems as described in §49. According to our theory of mechanical repulsion, two stars equal in temperature would not be united by the force of gravity because they would repel each other like two electrified pith balls charged alike; hence the majority of the hot stars would remain apart. But between these stars and a dead sun, or a live planet, or the fragments of a dissolved system of planets, there would be a strong affinity; and we can expect with reasonable certainty that such bodies will unite. There is no appearance of uniformity in mass or temperature among the bright stars, neither is there any appearance of uniformity in their age. On the contrary there is a very marked appearance of difference as to age. There is a difference of color among them, some being blue, others yellow and others red. This difference of color is no doubt a result of difference in temperature, the blue being the hottest, the yellow less so and the red the coldest. Our sun is therefore rather young; perhaps no more than 200 million years of age, or at least very hot since the blue in his light predominates. Owing to the great difference in the size and age of the numerous planetary or star systems scattered thruout the universe, we cannot expect them to have a uniform period of dissolution. It is most likely that old systems are dissolving and new ones forming all the time, at different points and at irregular intervals. And now let us see what takes place as required by mechanical laws, when the new system makes a start in life.

It cannot be doubted but that collisions may, and do occur between large masses of matter which have some physical difference, resulting in changing their mass motion into some other form. When two solids moving directly toward each other at a high rate of speed, come in contact, they are at once converted into a very hot vapor, which expands to many times the former volume of the two bodies. When a quantity of water is heated to more than 212° F, it will burst into steam and occupy 1,700 times the space. A mass of matter weighing 772 pounds, when allowed to fall thru a distance of one foot, will raise one pound of water 1° F. This is Dr. Joule's experimental result by which the mechanical equivalent relationship of heat and ordinary motion was established. On this data Mr. James Croll the mathematician, has calculated that in the collision of two bodies, each one half the mass of our sun, and moving directly toward each other with a velocity of 476 miles per second, a quantity of heat and light would be produced sufficient to cover the present rate of the sun's radiation for a period of 50 million years. All this energy being let loose at once it must be supposed that the ensuing mass would be converted into a glowing vapor, rapidly expanding to many thousand times its former volume.

Now in the event of a collision between two large masses, whatever be their physical relations, we can think of but three forms of motion as direct results of their impact; described as follows; (1), heat or molecular motion more or less intense and which would be communicated to the surrounding ether as light, electricity and wave heat; (2), a rotary motion of the mass on its axis; (3), a proper motion of the mass in a straight line thru space. The first named would be sure to follow and the second and third would follow dependent on how the two bodies came together. If they were equal in mass and velocity, and if they came together on a straight line, (which is possible but extremely improbable) no rotary motion nor proper motion would follow; nothing but heat. If they were unequal either in mass or velocity, but impelled together on a straight line, (which is also possible but not very probable) no rotary motion would follow, but there would be plenty of heat with a motihn of progression thru space. If they were more or less unequal in mass and velocity, and if they came together more or less out of a straight line, (which is by all odds the most probable) then there would be a rotary motion and a straight line motion along with a generation of heat proportional to the quantity of mass motion transformed into it. This reasoning so far as I can see, is in harmony with the laws of motion.

The intense heat thus suddenly evoked would give rise to light, radiant-heat, electricity and difference of pressure in the surrounding ether; and so the mass to some considerable extent, would be converted into a glowing vapor (a true nebula) lighting up the universe to a great extent in all directions. The rotary motion, which, in the majority of cases would be sure to follow, would give place to a centrifugal force around the equator, and this, acting against outside pressure would impart to the body the oval form. Thus we would have an oval or lense shaped nebula revolving on its axis, which axis is at right angles to the plane of its longest diameter

The reader can now see that this, in all respects, is exactly what we want for the beginning of the simple mechanical process of condensation described in §48, and which develops into a complete system of planets like the one we inhabit.

In such cases the time required to effect the change from the solid to the nebulous form, need not be very great; perhaps in the case of the largest bodies not longer than a few hours, and with smaller bodies less time. In the impact of two solids no matter what their size or mass, the transformation of their sensible mass motion into heat must be very close to instantaneous. During its period of greatest luminosity the body would out shine the brightest of the stars, but being greatly diffused immediately after the collision it would impart its extra molecular motion to the medium very fast, and so would cool down to a lower degree of luminosity. Hence its period of greatest brilliancy ought not to last long; perhaps no more than a few days. This must be inferred from the general fact that the rapid expansion of a gas or a vapor beyond the point of incandescence, has the effect of quenching its luminosity to some extent by increasing the amplitude of its atomic vibrations. If the amount of heat generated was sufficient to convert the entire mass into a vapor at once, then either a nebula having no condensed nucleus, or perhaps a nebulous ring, which, in time would cool and break up and scatter in all directions in its plane of revolution. But most likely in the majority of cases a central and most dense portion of the body would remain and around which the incandescent parts would form as appears to have been the original form of our system. From this revolving nebula having a more dense interior a planetary system would certainly follow as described and in strict obedience to the common law.

This would complete the third and last stage in the cycle of material changes which begins in the nebulous form, runs thru a long course of condensation which leads to the solid form and from this to the nebulous form again.

But we are not to suppose that this physical series is always and everywhere the same. It is highly probable that great quantities of ponderable matter may exist for many ages of planetary life, with hardly any change, if uniformly distributed thru the ether in small parts and under conditions which would permit of a uniform diffusion of motion. But such would not be the case within the limits of the Sidereal System and we can fairly suppose that the Universal Cycle is substantially true for this part of the universe. In the next section we will look for record evidence in support of this theory,

51. RECORD EVIDENCE FOR THIS THEORY.— Now it will be evident that if this cycle of physical changes as above described, is an actual fact in nature, that we ought to have some evidence of its truth either in the present records of astronomy, or thru a careful observation of the heavens in the future. The main points on which we would require evidence thru observation are.—(1), The destruction of planetary systems thru the dissipation of their substance in the form of solids of considerable mass, as described in (§49). (2), The collision of these bodies, either with each other or with other bodies, under conditions which would give rise to the incandescent revolving nebula as described in(§50). It would of course be impossible to witness the dissolution of a planetary system, since the bodies composing such a system would have to be almost completely destitute of molecular motion and therefore invisible to us. Besides the process must be very slow, no doubt occupying many millions of years. The lifetime of even the present human race is far too short to witness nature's greatest changes and if we are ever to know them we must conceive them in theory. But as to the truth of the collision of ponderable bodies, large or small, and that they may give rise to an incandescent revolving nebula exactly as would be required for the beginning of the formation of a system of planets with a central sun, we have to all appearances the very best of directly sensible evidence.

The records of astronomy furnish a number of instances of the sudden appearance of what is called "new or temporary stars." A common peculiarity of these stars is to blaze forth with a great and sudden light, sometimes far surpassing stars of the first magnitude, remaining so for a short time, then to gradually die away until they become either invisible or greatly reduced in brightness. The first on record of these new stars was seen by the Chaldeans 134 years B. C. In the year 389 A. D. another new star appeared in the constellation Aquilae which shone as bright as the planet Venus for three weeks, then faded gradually from sight and has never been seen since. In 1572 a remarkably brilliant star appeared suddenly in Casiopeia, which at first equaled in brightness the star Sirius, and soon after attained to a degree of splendor which made it distinctly visible at noon time. In about a month it began to decline in brightness and in six months entirely disappeared from sight. In 1604 another new star appeared in Ophiucus, which excelled the planet Jupiter in light, and remained visible for two years then disapeared; and in the same constellation, in the year 1848 another star blazed up in a spot where no star had been seen before. It equaled in brightness a star of the fourth magnitude, remained thus for a few weeks, then declined to the twelfth magnitude and still may be seen thru a good telescope.

According to Humboldt, the appearance of 22 such stars has been found on record since 134 B.C. and since his list was compiled two more have been added to this number; one appearing in 1866 and the other in 1867. An account of the two last, by a number of observers has come to my notice and from which I quote. In his "Familliar Essays Mr.R. A. Proctor says.—

"On the evening of May 12th 1866, a new star shown forth in the Northern Crown with second magnitude brightness, in a place where none had been visible with brightness above a fifth magnitude star twenty four hours earlier. On ascertaining however, the place of the new star, astronomers found that there had been recorded in Argalander's chart and catalogue a star of between the ninth and tenth magnitude in the same spot. The star declined very rapidly in brightness. On May 13th it appeared of the third magnitude; on May 16th it had sunk to the fourth magnitude; on the 17th to the fifth; on the 19th to the seventh, and to the end of the month it shone only as a telescope star of the ninth magnitude. Examined by the spectroscope this star was found to be in an abnormal condition. It gave the rainbow tinted streak crossed by dark lines, which is usually given by stars with minor variations, which enables astronomers to classify the stars into several different orders. But superposed on this spectrum, or perhaps we should say, shining thru it, was seen four brilliant lines, two of which certainly belong to glowing hydrogen. These lines were so bright as to show that the greater part of the light of the star, at the time, came from the glowing gas or gases giving these lines."

Here is satisfactory evidence for the sudden production of a large amount of intense heat and light, and this is a necessary factor in the physical series which maintains the life of the universe. A number of theories, says Mr. Proctor, were proposed to account for the sudden appearance and gradual decline of this star, among which was the supposition of the downfall of some great mass, perhaps a planet upon a star, by which the motion of the falling mass was changed into heat and light. Mr. Proctor hinself was of the opinion that a great stream of metoric stones traveling around the star might have come in partial contact with it, the same way that the small flight of November meteors come into collision with our earth three times in each century. The theory of the mechanical impact of solids is therefor not objectionable to astronomers, and really it seems to be the only theory to account for the facts. Those who would explain the facts by supposing some chemical action or form of combustion, should remember that all chemical changes are also mechanical. The significant fact in this case is the sudden production of a great body of glowing gas which rapidly cooles and contracts. This with the revolving motion of the body is all that's necessary for the making of a system of planets as described. Concerning the other new star, Prof. R. S. Ball in the Popular Science Monthly for June 1883 says.—

"On Nov. 24th Dr. Schmidt noticed a new star of the third magnitude in Cygni. The discoverer was confident that no corresponding object existed on the evening of the 20th. The brilliancy of the new star gradually declined until Dec. 13th Mr. Hind found it of the sixth magnitude. The spectrum of this star was carefully studied by many observers, and it exhibited several bright lines which indicate that this star differed from the ordinary stars by the possession of vast masses of glowing gaseous material. This star was observed by Dr. Copeland at the Earl of Crawford's observatory on Sep. 2nd 1877. It was then below the tenth magnitude and of a decidedly bluish tint. Viewed thru the spectroscope the light of this star was almost completely monochromatic, and appeared to be indistinguishable from that which is often found to come from nebula. Bearing in mind the history of this star from the time it was discovered by Schmidt, it would seem certain, says Dr. Copeland, that we have an instance before us in which a star has changed into a planetary nebulae of small angular diameter. At least it may be safely affirmed that no astronomer discovering the object in its present state, would, after viewing it thru a prism, hesitate to pronounce as to its present nebulous character."

In this case the spectroscope, in the hands of a seemingly competent person bears testimony for the truth of the actual production of a planetary nebula. If this nebula has the rotary motion and if not interfered with, its natural course thereafter would transform it into a system of planets like our own tho possibly no larger than the moon system of Jupiter.

At the conclusion of his article on this star Prof. Ball says. "This remarkable history might be edduced if we wished to procure evidence of the conversion of stars into nebula; but for the nebula theory we require evidence of the conversion of nebula into stars."

Here we have an astronmer of reputation giving his testimony without intending it, in support of our mechanical theory of the origin of the nebula from which planetary systems are evolved. He seems to be seeking for evidence of the condensation of nebula into stars, which stars may raise a family of planets like that of our sun, and which, he seems to think, would justify and extend the nebula theory now accepted. But to observe the change of a nebula into a star would of course be impossible in the life time of the human race, since it must be a long, slow process of radiation and condensation which must require millions of years; as, for example, our own system. The explanation of the sudden appearance and rapid decline of this new star, is no doubt the same as that for all the others; and it seems certain that the only tenable theory is that of the collision of large masses, one or more, with a small or very remote star, by which it is at once converted into a nebula thru a sudden and considerable rise of temperature. If no star existed in the same spot before, the new one must have been due to the collision of opaque and invisible bodies. A shower of meteors, if heavy enough might produce the same effect. The fact that the light of the most brilliant of the new stars so far observed has not much exceeded that of a first magnitude star, seems to indicate that they were either small in mass or very far from this earth. What would be the effect for us, of the direct impact of a body as large as the earth or larger, upon the star Sirius? No doubt our winter nights would be turned into days almost as bright as our mid-days and our moon would have to quit business. But what would be the effect of the fall of a similar mass into our sun? Very likely this earth and the other planets would do just what we would do when sitting too close to a hot stove; get further away. But we would stand a good chance of being scorched beforewe got far enough away. The planets would all sink deeper into the surrounding ether for the same reason that a float sinks deeper into a rare than into a dense fluid. The ether becomes more rare as a result of the rise of temperature.

Lord Lindsay, at his observatory in Scotland, carefully examined the new star of Nov. 1876, and in a letter to the London Times he says of it: "We have the extraordinary case of a star appearing suddenly in the heavens, giving a bright lined spectrum, which proves incandescence, and in the course of a few months its light becoming purely monochromatic. There is little doubt but that this star has changed into a planetary nebula of small angular diameter, though such a result is in direct opposition to the nebular theory."

Here we have another credible observer presenting facts in support of the mechanical origin of the nebula which may in time become stars with planets attending them; and he, like the others, fails to understand the true relations of the facts to the nebula theory. When we look at these facts from the more general and physical point of view, they very plainly show us the only part that can be seen of a great mechanical cycle of changes, (described in § 47, 48, 49 and 50,) by which nebula, stars and planetary systems, are produced.

Commenting on the history of this star Mr. Proctor says: "Now though the new star in Cygni presents no sensible disk, and still shines as a mere blue point in the highest telescope, yet, inasmuch as its spectrum associates it with the planetary and gaseous nebula, which we know to be much larger bodies than the stars, it must be regarded in its present condition as a planetary nebula, though a small one."

Mr. Proctor was known to be an experienced and careful observer of star phenomena, and his opinions can be relied upon as worthy of notic. So far there is substantial agreement in all of the above results of observation by different persons; and that it reveals the real manner of origin of the nebula which lead thru a clearly traceably mechanical process to the formation of planetary systems like the one we inhabit, cannot be doubted. If the astronomers of the future can learn that stars which make a sudden appearance in this way generally give rise to the incandescent gaseous nebula, the fact of their possible mechanical origin as described, would be established.

52. WHAT ARE PLANETARY NEBULA?— In different parts of the heavens the telescope reveals small hazy spots called planetary nebula. It seems that this name was given them simply because they resemble the disks of the planets when viewed thru a telescope. Sir John Herschel says of these objects:

"The planetary nebula have, as their name implies, a near, in some instances a perfect resemblance to planets, presenting disks, rounded or slightly oval, in some quite shaply terminated, in others a little softened or hazy at the borders."

In view of this general theory the name given to these objects is perhaps more appropriate than was first thought possible; for if this theory represents the truth these bodies not only resemble the disks of planets, but they, themselves, are the actual nebula, which, at some time in the past appeared as new stars, and which, after a long period of condensation will, at least in many cases produce stars with planets attending them.

Near the star Beta in Uras Major is a splendid nebula of this class. It is said that if this nebula was no further from us than 61 Cygni, it would have a diameter seven times that of the orbit of the planet Neptune, or 40,082 million miles; but it may be much further away. Its apparent diameter is 22-3 minutes of arc. Another nebula situated near the Cross has an apparent diameter of about 12 seconds and is perhaps much smaller. The disk of this one is slightly oval and well defined, its light about equal to that of a star just visible to the naked eye and its color a fine blue somewhat inclined to green. About twenty planetary nebula have been found so far and astronomers all agree that they must be great bodies of hot, self-luminous and diffused gaseous matter. These object, sappearing as they do in different parts of the universe, in view of our mechanical theory and of the facts above mentioned, lead us directly to the inference that they are now in the first stages of condensation, and will eventually produce lucid stars, and that at least some of them may develop into planetary systems as described. The fact that some of these bodies have the oval form proves that they have a rotary motion. A great body of highly heated vapor or gas could not have the oval form without having a rotary motion, which would tend to flatten its poles as described (§48). If so flattened it must revolve, and if viewed from its equatorial plane it would appear more or less oval according to its velocity of rotation. Those also which appear to us as a perfect circle may revolve without showing the oval form, if the plane of their motion is a right angle when joined to the line of vision. So it seems certain that some of these bodies have the rotary motion, and it is quite possible that many of them, perhaps the majority, have this motion. This is all that's necessary for a start in the evolution of a system of planets which may support life.

There is another class of bodies called nebulous stars, which seem to reveal a more advanced stage in the condensation of planetary nebula. In different directions may be seen stars which are surrounded by a faint halo or nebulocity. Some of these have well defined borders and others gradually merge into darkness. This nebulous envelope cannot be resolved into small stars by the highest power of the telescope. It may be inferred from physical laws that these bodies are either further advanced on the road of reduction to stars, from the original nebula, or that they are stars, which, to some extent have been set back toward the original nebulous form by the precipitation upon them of large masses of outside matter. In this way, it is very clear that a star may be changed into a nebula in a few days or weeks, but for the change of the nebula into a star or a group of smaller stars, either revolving or not, must require a much longer time.

Now as visible examples of the necessary stages in the great cycle of physical changes which is not only possible to matter because it is strictly within the law, but indispensable to the life of the universe, we have displayed in the heavens in the order suggested by this theory, the following: (1), new or temporary stars: (2), planetary nebula which revolve: (3), nebulous stars: (4), the rings of the planet Saturn: (5), our system of planets with the sun, the moon systems of Jupiter, Saturn and Uranus, also several hundred star systems which are known to revolve around a radiating star center.

So we have actually presented to the eye an example of each link in the series but one, and this one, from the essential nature of the process must be invisible because it must be conducted in the dark. This apparently missing link is the one that brings about the complete dissolution of planetary systems as described in (§49). But that this part of the series is just as indispensable as any other part, must be plainly evident; and we do not have to deny its existence because we cannot see it. Now in conclusion let us briefly pass in review the principal details of this series in the mechanical order of their occurence.

1. A great volume of intensely heated ponderable matter in the highly diffused gaseous form, is the first thing necessary for the start. There is just one way to obtain this large amount of heat in a large mass, and this is thru the collision of solid bodies large enough and moving fast enough to produce the effect witnessed. The more solid or the greater the specific gravity with a given velocity of the colliding bodies the better. Natural gases, unless they moved very fast in a body, would be deficient in momentum. Liquids would do better, but ordinary solids, in particular the most dense, would carry the striking force which would be certain to generate the degree of heat necessary to effect the disassociation of the most of the compounds, and to vaporize all solids. In this heated and diffused condition the body would be in all respects a planetary nebula like those described. The two new stars just described appear to give us a most satisfactory illustration of the way such nebula are produced; both in their sudden appearance and rapid decline, and most of all in the spectroscopic evidence of their nebulous character. Concerning the sudden appearance of new stars Sir John Herschel says: "It is worthy of special notice that all the stars of this kind on record, of which the places are distinctly indicated, have appeared without exception, in or close upon the borders of the Milky Way." This is a noteworhy fact in view of the theory here described; since it is in this part of the heavens that stars and planetary systems most abound, and where their dissolution is most apt to occur, that we should expect to find moving solids large or small, and that their collisions with each other or with stars, would be most apt to take place, resulting in the planetary nebula of the form required.

2. This nebula would have to revolve upon a central axis in order to produce a system of planets; otherwise it would produce only a star; or, if entirely converted into the gaseous form, leaving no central nucleus, it might produce a cluster of small stars which would have to repel each other for a time in

order to keep apart. Such a star cluster would never produce inhabitable planets because, before the outside ones had cooled far enough to support life they would fall into the central mass by reason of the greater outside pressure of the ether as due to the difference of temperature between the outside bodies and those within. The rotary motion of the original nebula would therefore be indispensable to the production of a life-supporting system of planets, and this, in possibly the majority of cases, would result from the collision of the solids necessary to produce the heat and light of the new star. The fact that we have in our own system seven different examples of this rotary motion, (namely, that of the whole system, that of the earth and moon and those of the five superior planets Mars, Jupiter, Saturn, Uranus and Neptune,) makes it clear that it may follow in the majority of cases.

3. During a long period of radiation and condensation this revolving nebula would produce a number of nebulous rings and these a number of revolving stars, and finally planets as described in §49.

4. These planets would stand a good chance to live thru another long period; and right here is where we and the other animals get in on the scene. Judging from the fact that we are now living on just such a planet, it may be inferred that the others possibly may pass thru a similar evolutionary process, producing vegetables and animals, and even those creatures we call men, who want a private monopoly of the whole earth, and who profess the doctrine of love one another while they practice the doctrine of eat one another, and who are the necessary progenitors of a superior human race. But eventually the same process of cooling and shrinking would break up the system and scatter its parts in all directions in its equatorial plane, as shown in §49. These scattered parts might be of all sizes from the visible lump of earth or rock to bodies as large as our moon or perhaps as large as any of our planets.

5. These bodies would still have motion, and it would be their motion of mass that would persist to the end because it would not be dissipated by radiation as would their molecular motion. For this reason, they for the most part would be in the solid form; and this is the form that fits them best to enter into the formation of new systems, since it is in the collision of solids that the required degree of heat is assured. It is also in the coming together of solids large or small, that the rotary motion is most apt to be produced. And so the process ends in the beginning of a new and similar process, which goes on and on, how long we cannot tell.

Since the above was written another new star has suddenly appeared in the Constellation Perseus near the famous variable star Algol. Here are some interesting facts about this star. Two nights previous to the night of its discovery the region in which it was discovered had been photographed, but no star brighter than those of the tenth magnitude appeared in its immediate neighborhood. On the night of its discovery the new star shown as a star of two and seven tenths magnitude. Its heat and light, therefore, had increased in two days, to more than 5000 times. It continued to increase rapidly in brightness until on the second night after discovery it had reached its highest point, which was three tenths brighter than stars of the first magnitude. After this it declined slowly. A few days ago (March 9th, 1901) it was of the 4th magnitude and was expected to disappear from sight in a few days. This star was first noticed by Prof. T. D. Anderson of Edinburg, Scotland, on Feb. 21st, 1901. Prof. T. J. See, the U. S. government astronomer at Washington, D. C. has expressed the opinion that this star was a dark sun in rapid motion, which had plunged into a cloud-like mass of nebulous matter, the friction in which had suddenly raised its temperature. But what is a dark sun? If such a thing exists it can only be accounted for under the theory here advanced. It must be a large mass of matter, possibly as large as our sun, which has cooled down so far as to be incapable of emitting light. The rapid rush of such a body thru a swarm of small meteoric stones, would no doubt produce the effect witnessed and we might expect a similar result even in a dense body of vapor. This is the mechanical impact required and in perfect accord with the present theory, and this form of contact called friction will no doubt apply to this case best because it agrees with the gradual rise of temperature, which required at least four days and nights from its beginning to its highest point.

In the "Popular Science Monthly" for April, 1901, appears a brief comment on this star, in which the writer says: "Any theory which aims to explain the phenomena must at least account for certain leading facts. The increase of light is very sudden and very great. The decrease is slower and sometimes irregular, but no collision can have occurred such as would change a solid body into a gaseous, otherwise ages, not weeks would be required in the cooling. ** It appears probable that the phenomena are due either to some outburst in the dark world itself, or else to the collision of a solid dark world passing thru a dense meteoric swarm."

The rapid passage of a dark world thru a dense meteoric cloud as an explanation, is not inconsistent with physical laws nor with the observed facts in this case; but if all physical activities are reducible to the laws which govern the motion of inert matter, it is not clear what would cause an outburst like this in the dark world itself. It could not have been a chemical explosion on a scale so large. Physical nature does not compound explosives in such large quantities. If the collision of two or more small bodies with each other or with a larger body, is possible, the collision of two solids equal in mass to this earth or even to our sun must be equally possible. If their momentum was great enough to convert the largest part of the material into a glowing gas, the effect would necessarily be attended by a very great expansion and diffusion of the material into the surrounding ether in all directions. This diffusion in the medium would of course be attended by a very rapid communication of the extra molecular motion to the medium, and hence a rapid reduction of the temperature to the point at which stable equilibrium between the internal expansive force of the body and the outside pressure of the medium had been reached. After this the cooling and condensation would proceed much slower simply because there is a more complete separation of the atoms and the ether. The atoms are gathered together in the central mass, the ether between them is much more rare, their vibrations are shorter and more rapid, and moving thru a nearly free space they retain their motion longer; and so it is that the lucid star may shine for ages with little diminution, while the new star may at first and for a short time undergo a considerable reduction of temperature. Looking at the matter in this way it does not seem necessary to exclude (at least in all cases) the collision of solids of great mass in order to account for the rapid decline of the heat and light of new stars.

53. CONCLUSION.—Several questions concerning the universe as a whole are now raised, and at least five of which may receive a brief notice before ending the book.

1. Is the universe limited in space? If the most powerful telescope yet invented can reveal stars so far away that their light must require millions of years to reach this earth, and if in this way we can sound the depths of the star-strewed space in every direction yet see no limits, then of course it requires some courage to even ask this question; and to attempt to answer it, will no doubt seem to many persons to be the wildest of speculations. The knowledge possessed by the animal world is limited to the sphere of sense and to what they can remember of sense experience. If the animals could make the attempt to answer this question they would most likely say that the universe is not limited. The majority of the people today will make the same answer. They do not seem to know that the old, narrow, animal habit of thinking is still upon them. If we cannot see the limit, there is no limit. Sense experience first, reason next; but the majority of the people never get beyond sense experience; hence they cannot reason. The law and method de-

scribed in chapters one and two will give us a decisive and final answer to this question. It was there shown that time and space, viewed as not related to anything else, are nothing; when viewed in their true relations to existing things, they are necessary objects of thought. Whatever exists, must exist in, or occupy, time and space. That which occupies space cannot exceed the limits of space nor can it co-extend with space because space in itself being nothing, is neither limited nor extended. So it follows that whatever exists must be limited in space. So with time. Whatever exists must have a time or period of existence which is inseparable from the thing existing. Time is not something apart from existing things; for if it was it would be something which does not exist. So it follows that whatever exists requires time and must be limited in space. This limited thing we call the universe of matter; with its mind and motion, the fundamental thing of all things. This foundation reality must co-endure with time because its duration without beginning or end is time itself. But its numerous changes of form, state, conditions or new creations, may be limited in time because they are only changes in this one everlasting thing. Herein we have the deepest of all relations, and it proves to be simply nothing-something. Beyond or deeper than this couple, right thinking cannot take us, because there is nothing deeper than nothing; nothing beyond or outside of time and space. So this universe must be limited in space, but unlimited in time.

The same conclusion may be reached from a different premise. From the inertia of matter and from sense experience, it appears that all sensible bodies are in constant motion and that motion persists because matter is inert. In order to explain all known physical facts it has been found necessary to assume the existence of an ether medium governed by the same physical laws, and which medium must be bounded on all sides by absolutely solid matter. With this assumption everything is readily explained; without it, this physical universe is a maze of disconnected bewildering facts. This way of regarding the question is simple common sense or ordinary judgment applied to things on the largest scale. Yet among all the critics to whom this idea has been submitted I do not recall one who has been able to accept it. All seem to understand the idea perfectly. They understand why a hen's egg must have a shell; some of them can even see why a stout iron boiler is necessary to retain and utilize the steam in a locomotive; but to apply the same idea to a thing so great as this whole universe, wy, its just awful, and I am told that my shell theory of the universe is no good. But to be true to my conviction that natural law is universal, that to know the universal truth we have only to learn the same truth on a sensible scale, I must hold to this view.

2. Is the universal cycle described in this chapter, permanent? It is upon this vast series of changes that the life of the universe depends, but since it is a series which, as we shall see, may be made. to deviate from a fixed routine, in fact that it is something which might have been created, the question whether it is permanent or not, is a far more difficult one to answer. While it is at present and very generally possible within the region of bright stars, it is not an universal fact. As already mentioned, large quantities of ponderable matter may exist for immense ages without any change, or at least without undergoing such a series of changes. But that all ponderable matter is liable to this manner of change, that it can be established as a series and maintained permanently or discontinued by the intervention of mind, will be made sufficiently clear as we proceed. Accepting the theory that it is simply a difference of mass between the small particles of the ether and the ultimate atoms of ponderable matter, also a difference of mass between the atoms of the different elementary bodies, which secures all the mechanical relations of the ether and the atoms, also the atoms and molecules among themselves, and under which theory we are able to explain and harmonize all physical facts, (chapters 3. 4. 5. 6 and 7), our nex tstep is to consider certain relations between the ether and the atoms which have never been noticed before and which may afford some light on this question.

All ponderable bodies from the smallest atom up to thelargest star, must meet with more or less resistance from the ether in their motion thru it. This resistance means the transfer of motion from ponderable matter to the ether, and this transfer is much more rapid from the atoms and molecules than it is from the large cold solids. The present motion of the earth in its orbit and on its axis, will no doubt continue with little diminution for many millions of years. But if all of this motion were suddenly transformed into heat, and if the earth was prevented from falling into the sun, all this heat would be transferred to the ether in a much shorter time. But whether the motion be that of a large solid or a small atom it is continually being transferred to the ether. Now the constant friction of the atoms, molecules and all their sensible aggregates in this ether, and the necessity that every center of aggregation of sensible size and larger, must result from the union of smaller aggregates, makes it highly probable if not certain, that, since the motion in such centers is being continually given to the ether thru friction and radiation, that the formation of such centers must gradually become less frequent, until finally all ponderable matter will have come to a stand still or nearly so, and all motion will have been uniformly distributed among the atoms and the ether. It thus appears that each unit of the ether, each atom and each larger solid will contain a quantity of motion proportional to its quantity of matter, resulting in a state of universal mechanical equilibrium, wherein aggregation and separation as in the described cycle of physical changes would be impossible. Such a state would violate no physical law. The uniform diffusion of motion in all movable bodies would be the final result and the present round of physical changes upon which the planetary life of the universe depends would be out of the question.

But in view of certain facts next to be considered, such a result, if not impossible, must at least be deferred to the end of a period of time far greater than we can estimate. As a planetary system undergoes condensation its most dense material will form solids, in some cases of great magnitude. The pressure of the ether would prevent the breaking up of such solids by their rotary motion. A cold solid displaces the ether in proportion to its density, and the more ether displaced the greater the pressure of the ether on the outside of the body. The units of the ether being the smallest of all the distinct portions of matter, and being immediately surrounded by empty space, must receive and retain motion until nearly or quite all of it has been transferred to the ether. It is therefore evident that the components of a system, at least the more dense portions, will remain intact until the last of their motion, even that of the whole mass has been dissipated. But the motion which would remain with them longest would be their motion of mass and this would certainly survive long after the system had been broken up and its parts scattered. These moving solids would stand a good chance to take part in the formation of new systems as already described. Now, tho it is true that the ether is continually absorbing the motion of ponderable matter thru friction and radiation, principally the latter, it is equally true that the ether is continually increasing the motion of ponderable matter thru acceleration due to radiation and difference of pressure. The law of the acceleration of the motion of falling bodies has been described in §21. The question now is; does this acceleration return to ponderable matter an equivalent of the motion imparted to the ether thru radiation and friction?

As already mentioned mathematicions have shown that if two solid bodies, each equal to one half the mass of our sun and moving directly toward each other under the force of gravity and at the rate of 476 miles per second, thus meeting in a head on collision, heat enough would be produced to cover the present rate of the sun's radiation for a period of 50 millions of years. If it is possible to estimate the quantity of motion transformed into heat in such cases, it ought to be possible to estimate the quantity of motion gained thru acceleration when two bodies fall together in this way thru a given distance; also to estimate the time required in gaining the motion. We can form some idea of the enormous gain which would be sure to follow when we consider the fact that, according to this law, a body falling from a high place will pass thru 16 feet in the first second of time, three times that distance in the next second and so on at the same rate of increase. It has been shown that if the motion of mass in our earth was instantly changed into heat, the temperatnre of the whole earth would be raised to a point equal to that of the rapid combusion of a mass of coal 14 times the mass of the earth or 11,200°. Then, after being warmed up in this way, if the earth should fall into the sun, (which it would, not having any centrifugal force to hold it back) its temperature would be increased to 400 times that amount or 4,480,000 times the present temperature of our planet. How long it would take the earth to fall into the sun is not known to me, but from the above facts it ought to be possible not only to estimate this time, but also to measure the quantity of motion gained thru acceleration during the fall. How long it would take the sun to expend the heat gained by the fall of the earth is also a mystery; but this too is a question which the man of figures might readily answer, and with this answer it must be possible to compare the time required in gaining by acceleration a given quantity of motion, to the time required in expending by radiation the same quantity of motion after it had been converted into heat; and what would be the difference? No doubt it would be like comparing a few days or perhaps no more than a month, with a million years.

So it would seem that while it requires millions of years to communicate a given quantity of motion to the ether by radiation, it requires an almost incomparably shorter time to return the same quantity of motion to ponderable matter thru difference of pressure due to the same form of radiation. From which we might assume that all the motion derived from the ether as due to acceleration, at the time of the formation of the original nebula from which our system was evolved, including that which its components already possessed and that which might have united with the system since the beginning of its development, may, at the time of its dissolution, be the exact equivalent of all that which was radiated from the system during the same time and that which it retains for the purpose of its dissolution. In short it must be a simple case of receiving and giving the same quantity of motion. The system cannot radiate more than it absorbs, neither can it absorb more than it radiate; allowing for that which is retained for its dissolution.

But how about the universe as a whole? It appears that while one system is dissipating its matter and the last part of its motion, as in its dissolution, another system just born or much younger, would be accumulating matter and motion by dissipating the first part of its motion as in radiation and difference of pressure; and that these agencies are reciprocally balanced, the ether returning to ponderable matter thru difference of pressure and the acceleration due to falling motion, at different times and places, an equivalent of the motion continually being lost by radiation at other points. So it seems that what is true of our system in this respect may be true of the universe.

Granting all this as entirely possible for a very long time, we are nevertheless not at liberty to accept it as an eternally enduring mechanical series. The present mechanical order of the universe has been shown to depend upon a certain difference between the atoms and the particles of the ether, also between the atoms of one element and another. This admirable arrangement which is necessary to the life of the universe, is, as we shall see later, most perfectly adapted to the operation of physical laws and to this great cycle of physical changes, and the question is pressing hard for an answer; is it permanent?

Chemists have put forward the claim that they are able to reduce the atoms to a point which they call a fourth state, in which they elude all tests for their presence. The fact that enormous quantities of hydrogen now exist within and above the photosphere of the sun, might be explained on the theory that it was manufactured there by the reducing action of intense heat, from larger elements, more readily than on the theory that it was left there by the slow condensation of the original nebula. It must at least be admitted as possible that the atoms are reducible to even that finest form of matter which we call the ether; hence no sure conclusion based on physical laws, can be accepted as to the eternal duration of the present order of physical changes.

But such questions must seem idle to many people because they are so far outside the range of the ordinary comprehension. Here we contemplate a mechanical system so extended in time and space as to be wholly beyond our most enlarged conception of things. We can approach it only on the supposition that what is true of a given mechanical process on a small and sensible scale, must be true in like manner of the whole. If law is universal then of course such speculations are warrantable. Besides, there is a fascination in them, for the speculative mind, which is well nigh irresistable. One question raises another, and that another, and the more we think the more we are impelled to think; and of all the questions yet brought up in this discourse, there are none more attractive, and as I believe more worthy of the serious regard of all men, than the one next to be considered; and the answer to which may serve as an answer to the present question.

3. Is there anything in this great material system which is superior to physical laws and more worthy of the name Energy or Mind? Is there any evidence of design in the system itself which would implicate the work of a Supreme Mind? It seems perfectly clear to me that every step in this (what I would call a rigidly exact inductive process from the beginning of the book to the last page), has been leading directly to an affirmative answer to this question. And here I want to mention that I have not followed this line of reason with any preconceived theory to justify. My sole object has been to find the universal harmony of facts as required by the recognized rules of inductive science. Following is a brief outline review of the principal steps which have led to the answer to this question of all questions.

In chapters first and second it was shown that nothing exists but things, that the Universe is all things and that Philosophy is their explanation. It was explained that Matter is the one universal thing in which it was necessary to create Difference and Relations, in order to permit the existence and the creation of all other things. In chapter third it was explained that the two first and most fundamental distinctions in matter are Motion and Mind; and that all further distinctions or thing, are due to difference in the Forms, States, Relations and Changes in Matter, Motion and Mind. It was also shown that Physical Energy is the motion of Inert Matter and that the law of its conservation is the Law of Inertia. And further, it was shown that Inertia and Consciousness are two opposite properties of the one substance Matter, that they are convertible into each other, the one disappearing when the other appears, and hence, that when matter is conscious it is not inert, and so may control its own motion, thus being able to act for self as in ordinary conduct, and thus to some extent being independent of physical laws.

This power of mind to control the motion of matter has been carefully considered and justified in book 2. Now, if this power belongs to the life of a planet it may also belong to a Supreme Spirit, and so there may be an Universal Spirit or Mind which is above and superior to the inertia of matter and which at any time may interfere with it so far as to control the direction of motion just as we do within our own brains every day we live. That such power has been at work in this physical universe at large, admits of no doubt simply because there is no other way to account for this material arrangement. We cannot regard it as a thing of chance, nor is it a physical accident; so it must be a creation of Mind, and this too on a scale of magnitude far greater than that possible for any being of planet life.

This is impressed upon us in a way that we cannot fail to understand, by a general survey of the facts in their systematic order. In all the conceivable arrangements of the substance of the universe there is really but one, in which the existence of a conscious mind as we know it on this planet, is possible; and this is in the differences, similarities, transformations and uniformities, which we perceive in the surrounding material world. We naturally ask; did all this come about by mere chance? And we might ask the same question in many other cases. How did we get this particular difference in mass between the atoms and the particles of the ether, upon which depends the difference, and hence all the important mechanical relations and results, in short, the entire physical universe as we see it at present, if it is not the work of an intelligent being with a definite object in view? Or how did we get the difference of mass by which the atoms are distinguished, and from which comes all the chemical properties of matter, all the colors, tastes, smells and forms of sensible objects, if there is no designing mind in nature? And how about this? If the universe of moving matter is inclosed on all sides by an absolute solid (and it surely must be) how did the motionless matter get outside and all around the matter which has motion? or, how did the motion get thru this solid shell and into the ether and the atoms, formed as they are to allow free space in which to move? How did the parts of a clock or a watch get together in that one particular way which was necessary to make a good time-keeper? It requires only the most ordinary common sense to answer any of these questions. Physical laws tho accessory to this systematic arrangement, could never have produced it alone. There is no chance for the sceptic to dodge, nor the careless to overlook this point.

This physical system is not only perfectly adapted to the operation of physical laws, but more significant, it is perfectly adapted to the evolution of life under necessary physical conditons. There are many different chaotic forms in which matter might exist quite as well as it now exists, but in which the present orderly arrangement would not exist. This is, without doubt, the one material construction and operation in which living beings clothed in flesh like ourselves and the others, could exist and be able to pass thru the evolutionary stages which raise them from the lowest to the higher forms of life. The two extreams of heat and cold are not adapted to the development of living organisms such as we have on this planet; hence the need of an intermediate temperature, along with all the other essentials, and this is brought about by instituting a mechanical series which repeatedly brings about and maintains for a time a planetary system like the one we now inhabit. The doctrine of design in nature has been opposed on the plea that living forms have adapted themselves thru natural selection and survival of the fittest, to existing and accidental physical conditions; and no doubt this is true to some small extent; but to a much greater extent it is evident that there must have been this arrangement of materials under physical conditions as necessary to give opportunity to the exercise of mind thru all its evolutionary stages. We cannot expect that a heated mass like our sun would be a fit place for planetary life. Our earth affords ample proof that the tropical and temperate zones are well suited to the requirements of life while the arctic regions are much less so, and these regions are warmer than the ethereal sea above our atmosphere. So we have examples within our own solar system, of the two extremes of heat and cold between which planetary life is possible, and nowhere else, and these are secured and maintained for a time by the present arrangement. No one would expect that a locomotive could have acquired its own perfect adaptation to physical laws and to human use, without the help of some thoughtful person who had some ideas about railroading.

Briefly stated, we have here a community of facts or mechanical elements, each one playing a necessary part in bringing out a result which is no other than the evolution of planetary life; the great variety of forms of life on this planet being examples. As evidence for the existence of a Supreme Mind, this seems entirely satisfactory, indeed it is hard to understand how anyone could wish for anything more convincing. If any reasonable person should discover a construction like this, here on earth on a small scale, they would certainly not hesitate to pronounce it the work of men; but we fail to see how any ordinary person could accomplish so much on a scale so immence. And another thing: it must have been a Great Spirit that did all this. No mind in the flesh could do it.

As to the future of the life of the universe we may now venture with a few conjectures. From the premise that mind is something which could not create itself, it follows that the Supreme or Universal Mind never was created. Being the soul Creator of all the forms of matter, motion, mind, (except those created by man and the lower animals, book 2), He could not create Himself without preexisting self in some other form of mind; and so on without limit. But will beings like ourselves and the others always continue to live, reproduce and die, under physical conditions as at present, or will there be a change? Without a doubt the duration of the present order which brings in the planets with their swarms of life, is immeasurably great, but we cannot say it is eternal unless the power of the Almighty is exercised to make it so; and as to His future plans of course we know nothing. If He is able to create He must be able to destroy or renew perpetually.

But in this view we can make at least one legitimate inference from physical laws. It was mentioned (page 252) that we have reason to believe that the atoms, which are the mechanithe universe there is really but one, in which the existence of a conscious mind as we know it on this planet, is possible; and this is in the differences, similarities, transformations and uniformities, which we perceive in the surrounding material world. We naturally ask; did all this come about by mere chance? And we might ask the same question in many other cases. How did we get this particular difference in mass between the atoms and the particles of the ether, upon which depends the difference, and hence all the important mechanical relations and results, in short, the entire physical universe as we see it at present, if it is not the work of an intelligent being with a definite object in view? Or how did we get the difference of mass by which the atoms are distinguished, and from which comes all the chemical properties of matter, all the colors, tastes, smells and forms of sensible objects, if there is no designing mind in nature? And how about this? If the universe of moving matter is inclosed on all sides by an absolute solid (and it surely must be) how did the motionless matter get outside and all around the matter which has motion? or, how did the motion get thru this solid shell and into the ether and the atoms, formed as they are to allow free space in which to move? How did the parts of a clock or a watch get together in that one particular way which was necessary to make a good time-keeper? It requires only the most ordinary common sense to answer any of these questions. Physical laws tho accessory to this systematic arrangement, could never have produced it alone. There is no chance for the sceptic to dodge, nor the careless to overlook this point.

This physical system is not only perfectly adapted to the operation of physical laws, but more significant, it is perfectly adapted to the evolution of life under necessary physical conditons. There are many different chaotic forms in which matter might exist quite as well as it now exists, but in which the present orderly arrangement would not exist. This is, without doubt, the one material construction and operation in which living beings clothed in flesh like ourselves and the others, could exist and be able to pass thru the evolutionary stages which raise them from the lowest to the higher forms of life. The two extreams of heat and cold are not adapted to the development of living organisms such as we have on this planet; hence the need of an intermediate temperature, along with all the other essentials, and this is brought about by instituting a mechanical series which repeatedly brings about and maintains for a time a planetary system like the one we now inhabit. The doctrine of design in nature has been opposed on the plea that living forms have adapted themselves thru natural selection and survival of the fittest, to existing and accidental physical conditions; and no doubt this is true to some small extent; but to a much greater extent it is evident that there must have been this arrangement of materials under physical conditions as necessary to give opportunity to the exercise of mind thru all its evolutionary stages. We cannot expect that a heated mass like our sun would be a fit place for planetary life. Our earth affords ample proof that the tropical and temperate zones are well suited to the requirements of life while the arctic regions are much less so, and these regions are warmer than the ethereal sea above our atmosphere. So we have examples within our own solar system, of the two extremes of heat and cold between which planetary life is possible, and nowhere else, and these are secured and maintained for a time by the present arrangement. No one would expect that a locomotive could have acquired its own perfect adaptation to physical laws and to human use, without the help of some thoughtful person who had some ideas about railroading.

Briefly stated, we have here a community of facts or mechanical elements, each one playing a necessary part in bringing out a result which is no other than the evolution of planetary life; the great variety of forms of life on this planet being examples. As evidence for the existence of a Supreme Mind, this seems entirely satisfactory, indeed it is hard to understand how anyone could wish for anything more convincing. If any reasonable person should discover a construction like this, here on earth on a small scale, they would certainly not hesitate to pronounce it the work of men; but we fail to see how any ordinary person could accomplish so much on a scale so immence. And another thing: it must have been a Great Spirit that did all this. No mind in the flesh could do it.

As to the future of the life of the universe we may now venture with a few conjectures. From the premise that mind is something which could not create itself, it follows that the Supreme or Universal Mind never was created. Being the soul Creator of all the forms of matter, motion, mind, (except those created by man and the lower animals, book 2), He could not create Himself without preexisting self in some other form of mind; and so on without limit. But will beings like ourselves and the others always continue to live, reproduce and die, under physical conditions as at present, or will there be a change? Without a doubt the duration of the present order which brings in the planets with their swarms of life, is immeasurably great, but we cannot say it is eternal unless the power of the Almighty is exercised to make it so; and as to His future plans of course we know nothing. If He is able to create He must be able to destroy or renew perpetually.

But in this view we can make at least one legitimate inference from physical laws. It was mentioned (page 252) that we have reason to believe that the atoms, which are the mechanical units of the present order, are reducible to smaller particles. Adopting this view, which is at least a possibility, it follows that a time will come when all ponderable matter will be reduced to a form of minute division similar to that of the present ether. In this universal medium all motion would be uniformly diffused and sensibly lost to the physical universe; in fact, there would be no physical universe. If this medium was bounded on the outside by an absolute solid, as it must be at present, it is then certain that the universe will have reached a state of absolute permanence; since it is impossible to see from physical laws that any further change could take place. At this very remote time the present physical order with its life, would be inpossible; and would have long before ceased to exist. And thus would end the most remote possibility of planetary life. Now, is this the end of all life? Does our theory of Mental Evolution lead us to nothing better than a dead universe?

As we shall see in book two there are hundreds of mental facts on record and now being gathered in all parts of the world, and which, when completely systematized and understood, will reveal a theory of mind and life, which is not complete until we admit as a necessary part of it, a future spiritual life for the inhabitants of this and all other life-supporting planets. When rightly put together these facts plainly show us the truth that the mental organism of man and perhaps that of all life, survives the death of the material body, and thereafter continues to live a purely mental or spiritual life, in which, physical conditions are absent and unnecessary. They are unnecessary because the external objective world in spirit life is purely mental, and created by mind alone. Being separated from this material objective world, and having no further use for its physical conditions, this purely mental life would be perfectly suited to a homogeneous ethereal medium, toward which the present physical universe is now to all appearance progressing.

So it would seem that by the utmost stretch of the speculative imagination, we can reach at least the possibility, that this Physical Universe and its life, will, in the end, be transformed into a purely Mental or Spiritual Universe, in which all living things are one with God.

4. What are the attributes of God? We have now reached the answers to three important questions. 1st. The physical universe is limited in space and bounded on the outside by an absolute solid. 2nd. The physical universe contains a vast mechanical system, perfectly calculated to serve the needs of the evolution of planetary life, but which may not be permanent. 3rd. The form and mechanical perfection of this physical universe, and its complete adaptation to the evolution of life, proves the intervention of a Supreme Mind, properly called God.

Now, the next question in order concerns the personality of this Supreme Mind. Is He a real person? What is the nature of His creative power, ecc.? According to the Bible and other authorities, God is an Omnipotent, Omnipresent, Omniscient Being. These are said to be His three chief attributes. The first means that He is possessed of unlimited or infinite power; the second, that He is present in all places at the same time, and the third, that He is possessed of infinite wisdom—knowing all things. As mentioned in the preface, it has been my object thruout this work to use Human Reason, as I understand it, as a test for all questions concerning God, Nature and Man. Here are the results of my reasoning on the attributes of God.

In book two it is shown that every living thing, from the most simple up to man, then thru all social states or forms of government up to God, is, and must be, a Mental Organism. A mental organism is an association of active mental elements, united thru a common center and always striving for agreeable relations. In the individual man or animal, the mental elements are called memories, faculties, organs and other parts of mind. In the society, the mental elements are called animals or men. In God, the mental elements may be called Humanized Men. In man and the lower animals the mental organism is essentially an individual—an association of active mental elements which cannot exist alone, and the relations of which, to some extent, must be agreeable. In society the mental organism is likewise an individual—an association of active mental elements (men or animals) which cannot exist alone, and the relations of which to some extent must be agreeable. Now, in the Supreme Mind, we have the highest form of the mental organism; and it must be an individual exactly the same, governed by the same law (§9, book two) as the lower individuals. If God is a conscious, thinking, rational Being, He must be an individual mental organism; simply because consciousness is impossible without a mental organism, at least of the animal type below and including man. In God we have the highest form, the most perfect development, of the individual mind and we can fairly call it the culmination of mental evolution. Not that God is a direct product of the law of evolution, but that evolution clearly points the way by which man may become completely Humanized and one with God.

"I and my Father are one. * If I do not the works of my Father, believe me not. But if I do, though ye believe not me, believe the works: that ye may know, and believe, that the Father is in me, and I in him." John 10: 30, 37, also 14: 10, 11.

Here and in many other places in the Christian gospel we have the words and the works of a man who has proved beyond question that he was one with God the Father of Humanity.

Here also we have a series of mental organisms showing the different stages of mental development from the lowest animal up to man, then thru the several forms of the social mental organism up to the one which truly deserves to be called the Righteous State. Now, in our search for God within the sphere of our knowledge, it seems certain that we must look for Him in this series of individuals which show the different stages of moral and intellectual development. We cannot place Him anywhere below man, neither can we place Him as low as even the highest of men. To be a thinking being possessed of the highest known moral and intellectual attainments, He must be an individual mental organism something like the present most perfect man but much higher. To be able to create a universe like this, He must be able to control an amount of power far greater than that of the most perfect single man known to us. He cannot be a combination of men like a social state in earth life, because we have no example of a perfect social state sc far in history and there is good reason to believe that, in the present mixed state of society, men cannot be united on the most agreeable terms so as to act together as one man, simply because the average man is still a half-animal creature incapable of the higher developmt within a few generations. As shown in book two, men may be united far more closely under the law of selective mental affinity in spirit life. It therefore seems perfectly clear that we have no choice but to admit that God is, and must be, a vast Congregation of the most Exalted Spirits.

Swedenborg's account of the God of heaven comes nearer to what I would suppose Him to be, than anything I have seen in print so far. I quote the following from his 'Heaven and Hell.'

"The first thing necessary to be known is, who is the God of heaven; for everything else depends on this. * I have often conversed with the angels on this subject, and they constantly declared, that they are unable to divide the Divine Being into three, because they know and perceive that the Divine Being is One, and that he is One in the Lord." (page 4.)

From this and many other passages in Swedenborg's writings it appears that the people of the highest spheres in spirit life, can believe only in one all prevalent Divine Being, who is in each one of them and in all things, shaping every thought and act. This is conspicuous in the following: "Every one in the heavens knows and believes, yea, perceives, that he can neither will nor do any thing of good, nor think and believe any thing of truth, from himself, but only from the Divine Being, thus from the Lord; and that the good and truth which are from himself, are not really such, because there is no life within them from a Divine source." Which substantially means that the Divine sphere of the Lord constitutes Heaven, "and that it is not constitututed by the angels or by anything proper to them.' p. 7.

It is even asserted by this author that heaven has the exterior form of an ordinary man, both as a whole and in its subordinate parts. Here is a summary of his views up to page 43.

1. "That the Lord is the God of heaven. 2. That the Divine Sphere of the Lord constitutes heaven. 3. That heaven consists of innumerable societies; and that each society is a heaven on a smaller scale, and that every angel is a heaven in miniature. 4. That the whole heaven, viewed collectively, is in form as one man. 5. That every society in the heavens is also in form as one man. 6. That thence every angel is in a perfect human form. All these truths point to this conclusion: That the Divine Being, whose Proceeding Sphere is what constitutes heaven, is Human in form. * That such is the fact, has been evinced to me by much experience, part of which shall now be related. No angel in all the heavens ever has a perception of the Divine Being under any other form than the Human; and, what is wonderful, those who inhabit the superior heavens cannot think of the Divine Being in any other manner. They derive the necessity of so thinking from the Divine Sphere itself which enters into them; and also, from the form of heaven, according to which their thoughts diffuse themselves around. For every thought conceived by the angels diffuses itself into heaven around about them, and they enjoy intelligence and wisdom according to the extent of that diffusion. Hence it is that all in heaven acknowledge the Lord, because there is no Divine Humanity except in Him."

The diffusion of thought mentioned above, is a possibility even here on earth between persons who take some interest in each other, and it is now known as Telepathy. (§34, book two.) I have tried to show elsewhere that this is the spirit sense, imperfect in earth life but perfect in spirit life. This is the tie that binds souls together in spirit life, and the closeness of the union will depend on the moral and intellectual development of the people who form the society. Since all social intercourse in spirit life must be purely mental (not thru physically guided motion as in earth life,) it follows, that in order to secure agreeable relations, societies must be formed by a selective process dependent on mental affinities. In this way the most perfect and lasting unions, in which there is the most agreeable relations, are secured. Thus the society becomes a mental unit, which, in all cases thinks and acts as one man, and which, in the most strict sense of the word is an individual mental organism. Now, if a being like this lived wholly within itself, nothing to do with anything outside, it would have no use for a unifying center in which there must be a distinct person who performs the office of administrator. But since heaven consists of innumerable societies and since each one of these is a heaven in itself, differing somewhat from the others and having something to do with the others, each society must be, in itself, an individual having a unifying center, in which is located either a single presiding spirit or a group of them, who act as administrators of the Divine law. This view is necessary from the form and mode of operation of the mental organism as described in Chap. two, book two, and according to which, every organism, individual or social, must have a governing center consisting of one or more of its component individuals. All that I have been able to find so far in Swedenborg's writings, as to the existence of such a center, is the following:

"That as heaven collectively is as one man, so every society is as a man on a small scale, and every angel on the smallest. That in the midst dwell the most wise, and in the circumferences, by degrees, extending to the boundaries, those who are less wise; and that it is the same in every society." (page 112.)

Also in the matter of light or intellectual development, we find the following on page 73:

"The light, also, is not the same in one society as in another. It likewise differs in each indivdual society; those who inhabit the center enjoy more light, and those in the circumferences, less. In one word; in the same degree as the angels are recipients of Divine Truth, or are grounded in intelligence and wisdom from the Lord, they have light. On this account, the angels of heaven are called angels of light."

To make everything clear as far as this author has gone into the matter, it will be necessary to quote a passage or two from his chapter on Hell, page 394:

"When treating above respecting heaven, it has everywhere been shewn, that the Lord is the God of Heaven; and thus that the whole government of the heavens is that of the Lord. Now, as the relation which heaven bears to hell, and that which hell bears to heaven, is such as exists between two opposites, which mutually act against each other, and the result of whose action is a state of equilibrium, in which all things may subsist; therefore, in order that all and everything should be maintained in equilibrium, it is necessary that He who governs the one should also govern the other. For unless the Ruler were to restrain the assaults made by the hells, and to keep down the insanities which rage in them, the equilibrium would be destroyed and with it the whole universe."

It is thus clear that Swedenborg's idea of the personality of God, as derived from his direct clairvoyant communication with the people of spirit life, is the same as my own, up to a certain point. He believes that God is an individual, all-wise and all-powerful. As I shall try to make plain later, God must possess the highest possible wisdom, but His power must be limited to *the* number of united and humanized spirits who constitute heaven. But nowhere in Swedenborg's writings do we find any intimation that the personality of the Supreme, is simply a result of the union of a great number of the highest human spirits. On the contrary, he tries to make it clear in a number of places, that God is a distinct Person, totally independent of the universe over which He presides. Yet it is admitted, at least in one place, that the power in heaven appears to come from the angels themselves. Read the following page 395:

"This sphere from heaven was perceived to be from the Lord alone, though it appeared to come from the angels in heaven. The reason that it was perceived to come from the Lord alone, and not from the angels, is, because every angel in heaven acknowledges, that there is nothing of good and truth originating in himself, but that it is all from the Lord."

Now, from certain laws of mind fully described in book two, also from the Christian gospel, it seems that we may not be far from the truth if we suppose that the Supreme Mind of the universe, is not a single individual like an ordinary man, nor yet a single society or combination of such men, but a combination of all the individuals or societies from the lowest of the animals up to the highest of men. He is the Universal Mind, and this limited Physical Universe is His material body. He is a Spirit just as all mind is spirit. His power is that of mind; the same which is used in the bodies of every man or animal on earth and fully explained in book two. His knowledge is absolute—as complete as is possible in a limited universe like this. He is in every place in the universe where there is conscious mind, but His attention is governed by the law of the individuality of consciousness described in § 9 book two. For this reason He cannot be attentive to all that's going on in the universe at the same moment. He is the Supreme Ruler of the Universe—earth, heaven and hell and all things therein. Nature's laws are His laws and all that is or that happens is right and good in the ultimate sense because it is necessary to the consumations of His plans for the Creation and Salvation of Men. (chapter four, book two.)

As already remarked, if we attempt to designate any part of this Universal Mind as the one Omnipotent God, it seems that we must regard Him as an Association of the most exalted human beings in spirit life. Such beings are united as one man and governed solely by the moral law as set forth in the Christian Gospel. In such a combination we would have the source of the greatest mental power that seems possible. Knowledge is power and knowledge is mind. To get this power to the highest degree, there is just one way—the association of organized and active mental elements, under the most agreeable relations. To secure the most agreeable relations, the mental elements must be of that highest order known as humanized men. This would constitute the brains of the material universe; all the other and lower parts being the body and the whole being God in Person.

There is no discrepancy in this view, in the light of the gospel of Jesus. When he said to the doubting Pharisees: "I am the light of the world: he that followeth me shall not walk in darkness, but shall have the light of life. * Though I bear record of myself, yet my record is true; for I know whence I come and whither I go. Ye judge after the flesh; I judge no man. And yet if I judge, my judgment is true; for I am not alone, but I and the Father that sent me. * Believest thou not that I am in the Father, and the Father in me? the words that I speak unto you I speak not of myself; but the Father that dwelleth in me, he doeth the works." (John, 8: 12-16, and 14: 10.) He was simply the medium of communication between that great and most closely united Congress of humanity, of which he was one himself and whom he has rightly called the Father. God is therefore an individual just as any animal, man or society is an individual, and being the highest of all individuals He must be a vast association of the most Exalted Human Spirits.

No doubt this view will be objected to by those who have not all the facts on which to rest a judgment. Better withhold judgment until all the facts are in. Just as any man or animal cannot exist without being an association of mental elements, organized and active for the purpose of securing agreeable relations, and just as any society cannot exist without being an association of individual men or animals, organized and active for the purpose of securing agreeable relations, so God cannot exist without being an association of the highest human beings organized an active for the purpose of securing the most agreeable relations. Just to the extent that the innumerable forms of the Universal Mind are agreeably united in this way, to that extent they constitute God and heaven; and just to the extent that they are lacking in this, to the same extent they are deficient in that which constitutes the Fatherhood of Heaven; and so they are that much nearer to Hell. God is thus the Moral Law which is in each one of His constituent parts; hence it is not necessary that any part should act as chief magistrate. It is only in the lower and less advanced individuals that an executive officer is necessaary. This to conform to laws of mind. (book 2.)

5. What is Creation? According to our best Dictionaries the word 'creation' is used with at least two meanings; 1st, the act of creating or calling into existence, something out of nothing; 2nd, the act of producing something new in form, out of something already existing. In this section I shall aim to prove that the word creation has a true meaning only when used in the sense last named above—that the idea of the creation of something out of nothing is both unreasonable and unnecessary.

A frequently quoted definition of the word 'creation' as used in the sense first named, is found in John Locke's "Human Understanding." He says: "When the thing is wholly made new, so that no part thereof did ever exist before, as when a new particle of matter doth begin to exist in rerum natura, which had before no being, this we call creation."

This, of course, means the production of something out of nothing. Here is another definition, somewhat broader in scope, but the same as to meaning. The Rev. Joseph Benson in his Commentary on the Scriptures, says:

"Created.—That is, brought into being, gave existence to what had no existence before, either as to matter or form; both making the substance of which the different parts of the universe were formed, and giving them the particular forms which they at present bear. How astonishing is the power that could produce such a world out of nothing. What an object for adoration and prase; and what a foundation for confidence and hope have we in this wonderful Being who thus calls things that are not as though they were."

I have quoted the above as examples of the current definitions and beliefs regarding the matter of creation. I have also talked with many preachers and priests on this subject and they have all held to the view that something can be created out of nothing. That this is a clear result of that transendental education which has led people to overlook their native common sense, is plainly evident. Let us glance for a moment at this matter in the common sense way. We think about it a great deal and we come to the conclusion that some mind, most likely God himself, was the creator of all things, simply because we cannot suppose that a big thing like a world could make itself. Having got this far we take a rest, and then we think some more; and by and by another question comes up. How about mind or God? Did God create Himself? This hits us rather hard. If a first mind was created, then there must have been a time when there was no mind; and of course nothing else, because the first mind would have to get started in order to be on hand to create the other things. So we've got to suppose, or get at it somehow, that the first mind which was created, and which had to create itself out of nothing, managed to work around and get ahead of itself so as to perform the act. We don't see how it was done, and we never get any further on this line. What we do next will depend on how we think, or whether we think at all; and right here we are up against the real question and the way to settle it. If we are one of those who do not think, but still have mind enough in us to feel like going to heaven when we die, we will very likely sell out body and soul to one of those blatant preachers who tell us not to reason about sacred things and who will lead us gently into the fold with the rest of his sheep where we are perfectly contented as long as we don't get into the human habit of thinking. But if we are disposed to do a little thinking for ourselves, knowing that this is a God-given right which no real man would dare to question, we may be able to look at the problem somewhat as follows.

Everybody must know that good judgment or reason is necessary in all the questions of life, not excluding those ultimate questions of the future life and the universe as a whole. Everybody must know that good judgment can only proceed on knowledge, and that the wider and deeper the knowledge the better the judgment. Admitting this, it follows that all questions, great or small, are questions of knowledge. What do we know about it or how do we know anything? When we inquire into the matter carefully we cannot fail to see that all knowledge comes to the individual animal, man or society, thru sense experience. The range of the physical sense in man is limited; beyond which limits many things exist, as we have very good reasons to believe. All our knowledge of that which exists outside the range of sense experience, must be inferred from sense experience. This is properly called inferential or theoretical knowledge. The truth and value of all such knowledge will always depend, (1), on the scope of the sense knowledge, (2), on the care exercised in making the inference. Besides the external or physical sense we may now recognise another avenue of sense, which is rightly called the internal, purely mental or spirit sense. (§43, book 2.) The external sense is located in the five external physical sense organs and the internal sense is located within the brain, and in, or very close to the center of self consciousness. The external sense gets its impressions directly thru forms of physically guided motion from without, and the internal sense gets its impressions directly from forms of consciousness and mentally guided motion. The impressions coming to the internal sense generally come directly from the physical sense organs; in fact this internal sense organ serves as an intermediate between the outside organs and the mind within. The internal sense organ may also receive impressions from without, and often from a distance much greater than the range of the physical sense, and which impressions are purely mental and independent of the physical nervous system. All communications for the internal sense must come to it in forms of conscious mind and mentally guided motion; as fully explained in next book.

Now, all our ideas about things, all the forms of the understanding, are derived or inferred from our sense experience as described above. All human beliefs grow out of sense experience alone, and the great variety in human beliefs is a simple result of the difference of degree in intellectual development. Men always think and act as their sense experience and capacity for right judgment determines, and hence their beliefs. All the different ways by which truths and beliefs, whether true or false, are arrived at, may be approximately classed under the three heads: Genius, Imagination, Reason. These three divisions may to some extent, be regarded as three stages in the intellectual development of man; but they are not clearly defined. At the present time genius and reason occupy the antipodes with imagination covering a large middle ground which overlaps both the others. Let us briefly consider them separately.

The genius is one who is highly endowed with the faculty of receiving sense impressions from without, and which come directly to the inner sense and not thru the medium of the physical sense. This is the spirit sense, imperfect in physical life, now very little known and misunderstood. It is feeling or sense experience without a physical nervous system and to some extent without the guidance of the rational will. The genius is generally deficient in the reasoning faculty; which, being closely associated with the physical sense and the things of this world, tends to interfear with the dreams and visions of the genius. He may not know the source of his sense inspirations, he may fail to understand their true meaning and they may lead him to imagine all kinds of foolish things. The weakness of reason is the strength of genius. Dogs and cats and perhaps all animals are more or less possessed of this faculty; as shown by the fact that they are able to find their way when lost without the use of the physical sense and judgment. The home of the animal is impregnated with his own mind and no matter how far we transport his body his mind is not detached from that part of it which is impressed in the walls of his home, and thru this mental connection and desire to return, a simple sensation is all that's necessary to guide the animal to where he wants to go. He follows an inner impulse, which he does not understand but which serves his purpose, and so he pays little or no attention to his memories of objects of sight. It seems possible that God may sometimes influence the mind of the genius of human kind, with important truths or hints to man. Or from what has gone before it is perhaps more correct to say that there are geniuses who receive impressions from the great repository of universal truth, which can be no other than God himself. But we have good reasons to suspect that the work of the inspired genius is often false and misleading. He is apt to misunderstand his own impressions and he may be inspired by the imps of the infernal regions. The only sure test for the truth or value of the products of the genius, comes thru the careful use of Human Reason.

Imagination might be defined as the ofspring of genius and the childhood of reason. That the three merge into each other is evident, but it is not easy to tell where one begins and the other ends. Ever since man commenced to keep a record of his thoughts and of current events, imagination and reason have been racing within him on all subjects of interest. From the early records it seems plain that imagination was fleet enough in those days to keep far ahead of reason. The myths that were current then would stand no show for credit in the civilized parts of the world today; which means of course that the world has been growing mentally. But in some localities and among certain classes, imagination is still a good length ahead of reason. The man who has nothing but his imagination to guide him never jumps the track because he is never on it. He may possess knowledge of isolated facts but his inferences from such facts do not proceed upon a knowledge of the true relations of such facts and not being guided by any method of inference, he is on no line of truth which may lead to the ultimate truth. It is imagination that makes the animals take fright at strange objects, when a little judgment from sense experience might show the object to be perfectly harmless. There is a close similarity between the animals and ourselves in this respect—some of us at least. The gossiping neighbor who sows the seed of strife in all seasons, is kept going by imagination; in fact it is to this rampant trait that we must credit all the foolish sentiment that afflicts society. But we cannot dispense with imagination for it is the beginning of reason. First the child, then the mature man.

Reason may be defined as the crowning accomplishment of the human intellect. The reasoning man is the finished man, the perfect work of the Creator. Godliness is that simple rationalism which includes all the Christian virtues and proceeds on common sense, and if we would be one with God we must brush up this germ of reason which has been given us to cultivate. There is one way and only one way to get to heaven while there are many ways to fail to get there. To accept all that the Bible or the modern church tells us, as true, without the test of reason, is one of the sure ways to miss heaven. The one way to get there is to realize that the true word of God is not alone in the Bible and in the mouth of the preacher, but in all Nature; in fact that Nature and God are One, and that to attain to the most complete knowledge of this One, and to become one with Him, is to put to its highest use this highest faculty of mind.

There is hardly anything plainer to human understanding than the fact that reason has been developed out of the most crude imagination. The creative plan which has made reason, can be plainly traced under the law of Mental Evolution, which now is, and always has been, an efficient instrument in the hands of God for the perfection of life. It is only reason that can comprehend the true relations of the facts of sense experience, and it is in this comprehension that the mind can trace out long lines of relations, connecting facts in great systems and thus revealing laws of the universe. It is reason alone that can correct the mistakes and interpret aright the truths uttered by the inspired genius, and it is able to do this by its infallible method of induction. Now, what has been the attitude of genius, imagination and reason, toward the subject of the creation? It seems that all have admitted that some sort of creation did really take place at some time in the past. Genius has been inspired to give the world some plain hints on the subject; imagination has imagined itself to be the only true interpreter of the hints of genius and so has made a meaningless mess of the whole subject, while reason has made several safe and sane moves toward a final solution of the great problem. And what has reason done?

It is a noteworthy fact that the very first passage in the Bible, is one of the most significant on this subject, that can be found in that immense book. When taken for just what it says and no more, it conveys all that the most exacting reason could expect, as the true and simple word of God; first written by Himself, on the tablet of Nature, then conveyed to man. Here is the passage: "In the beginning God created the heavens and the earth." Genesis, 1: 1. This is all that's said regarding the first act of the creation, and no one can doubt but that this was the first act. Taking these ten words for our text, there is only one point that reason permits us to make. There was a beginning for the heavens and the earth; beyond which time they did not exist. But how was it done, or what is creation? On this point the record has nothing to say, and perhaps there is a reason for this silence. It may not be in accord with God's plan of mental evolution to give to man all the secrets of Nature at once. He gives us a hint now andthen, just enough to stimulate our curiosity, then we begin to imagine; and when we get this far there is always a chance for reason in view of the mistakes of imagination. And one of the great mistakes of imagination, is to look for the complete word of God in the Bible. At best that book can contain no more than a hint here and there, and even these are always doubtful until they have been carefully examined in the light of reason. At its best that book is a dark, forbidding and bewildering jungle of absurdities; creations of man's imagination, with here and there a glimps of the truth by the inspired genius. It is purely the work of man in the imperfect stages of his intellectual development, and we should read it rationally and critically; exactly as any sane man reads any other book. For proof that the Bible is not the word of God we have only to read the first verse of the first chapter of the four gospel by the Apostle John. And in connect with this, read also Luke, 9: 54-56. John may have been a genius; not a reaoner.

"In the beginning was the Word, and the Word was with God, and the Word was God."

How can we mistake the meaning of this passage. Not only God himself, but also His Word, existed before heaven and earth were created; before man was created and of course before the Bible was written. The true word of God therefore, was never written by the hand of man; for only in small part it was foreshadowed to the genius and thus committed to writing. The statement of Moses is merely the bare mention of an occurrence; nothing is said as to what is creation. Can we accept this as the full and sufficient word of God, on the creation? The statement of John goes a little further. He says, 1: 3. "All things were made by him; and without him was not anything made that was made." This passage plainly intimates that something existed before the creation which was not created. What that sonething was, we shall see later. That John possessed the highly impressible nature of the born genius, there is evidence. It is said of him: "John was called by his brother James to follow Jesus. (Matt. 4: 21.) His nature was that sensitive one which is the temperament of genius, eloquence, passion and love. * In the fourth gospel the loving elements of his character alone appear. He was the disciple whom Jesus loved."

Perhaps we do not miss the truth very far if we admit that this man was a heaven inspired genius, and perhaps the same may be said of Moses. But it is very evident that neither one of these have given us a satisfactory account of the creation; and it is not reasonable to accept their meagre statements as the ample and all satisfying Word of God on that subject. Now, if the Bible has failed to answer this question suppose we try reason, and first let us examine the Scriptural account.

When we think of anything as being or occurring, we must think of it as being or occurring in time and space. The simplest form of thought is clearly impossible unless it be of something which has a past, present and future,—as being or occuring in a series of succeeding events, and somewhere in space as related to other things. The first three words of the Bible "In the beginning" plainly refer to something which occured in time and space—at some time in the past and somewhere in space. The next seven words "God created the heavens and the earth." have but one very simple meaning, and it seems certain that nothing but the wildest imagination could overlook that meaning. They do not refer to God himself, but to his work. He did not create himself because it was not necesary even if it had been possible. At least the account does not say so. Like any good workman he was on the job from the word go; and he must have been around somewhere before it was time to begin. If we take these words for just what they mean and no more, we cannot escape the conclusion that something existed before the heavens and the earth were created. God himself was present and how can we think of him as being thus engaged without thinking of a mind which is conscious and intent on what it is doing. Reason is not really necessary to bring us to this conclusion. It would seem that the most ordinary common sense should be sufficient. But reason is necessary to head off our imagination when it gets after one of those ecclesiastic injunctions about everything being possible to God no matter how unreasonable it is to man. If God created the heavens and the earth he must have used his mind. Now, a complete and thinkable theory of the Universe, as so far worked out in this book, is the one which requires that mind cannot exist without being a property of the one space occuying substance which we have called matter; and that mind cannot act without the motion of matter. From all which it plainly follows, that if God created the heavens and the earth, he must have done so by reason of the pre-existence of matter, motion and mind. Now, if reason can show us that only matter, motion and mind are necessary for the foundation of a complete and perfect Theory of the Universe, which has a face guarantee of being the true Philosophy of Things, then in view of the foregoing we must listen to reason.

In chapter three it was shown that the three most deep and most general of universal truths are: (1) Matter, (2) the Motion of matter, (3) the Mind of matter. In chapter three book two it has been shown that when matter is conscious it may control its own motion, and is therefore independent of the laws of motion which we derive from the inertia of matter. All motion is thus controled in two ways: (1) physically guided motion; (2) mentally guided motion. Physically guided movements of matter may result in new forms of matter or motion, and these are physical changes governed entrely by laws of motion. Mentally guided movements of matter may result in new forms of either matter, motion or mind, or all three at once, and these are both physical and mental changes, governed by laws of the conscious mind. Physical activities do not produce any new forms of matter or motion which are a result of design or purpose, because design or purpose belongs only to mind and mind must be conscious in order to conceive a design or execute a purpose. Hence it is that all created things must be created by mind—by mental activity and mentally guided motion.

To explain further, when any living being learns anything new, the new acquisition always consists in the addition of new forms of mind to those already in the organism. The new forms take shape in the adjacent parts of the brain or material organism, which parts are not already occupied; and they are created by the individual, thru sense experience, knowledge and judgment. These new forms of mind are supposed to be created out of the formless mind which is necessarily a property of all matter and which is contained in the matter not yet occupied. (§8, book 2). Thus not only the new individual at the time of birth, but all subsequent mental development or growth, from birth to physical death, is created by mind and out of unformed mind. In book 2 it will be shown how all objects in spirit life are created by mind. This is creation on the mental side.

All bodily develoqment or material additions to the body, are creations of the mind operating within the body. In this mental and bodily development we observe the operations of the great law of evolution to be considered in the next book. When any living thing produces anything new in forms of matter or motion or both, there is first, a mental act within the brain and directly upon the conscious matter of that organ, thus giving the desired direction to the mentally guided motion therein. This motion going out thru the muscular system guides the moving organs as required in the creative act. Thus, all new material things with their activities, are creations of mind; and this is creation on the physical side.

When God created the present form of this material universe, he might have used the same power in the same way, as now used within the brain of every man or animal on earth. If we suppose that the Supreme of the universe is an individual composed of a vast number of the highest human spirits, all united under the one moral principle and acting as one man, there is nothing impossible or unreasonable in this solution of the problem of the creation. We have only to explain how any man is able to control the movements of his right hand, in order to know how God created the universe. Knowing the power of a single human being it is only a question of figures.

But in spite of all that can be acceptable as trustworthy in the Bible, men have always been asking, and still they ask, is it possible tò explain the first cause? If God created all things who created God or how did he make a start in life? The idea of a first cause for everything that exists is as old as the races of men and it is entertained by not only the most unlearned, but even by those who have attained to the highest distinction as original thinkers and men of lettesr. The battle of reason against imagination is still furious everywhere, and we may even find this conflict raging in the brain of the same person. The late Herbert Spencer was a remarkable example, even tho he gained the distinction of being the world's foremost philosopher. In his "First Principles," he has more than a dozen pages on this subject of the first cause. He reviews all the known theories under the three heads, "Self-existence, Self-creation and Creation by External agency." Self-existence means existence without beginning or end—eternal existence. Self-creation is supposed to be the creation of something, by itself, and out of nothing. Creation by external agency is the creation of something out of nothing by something else; or it may be the creation of something out of something else and by something else. All of these theories are summarily disposed of by this philosopher in the following passage; which seems eloquent enough in its arrangement of words, but far from convincing in rational argument.

"Thus these three different suppositions, verbally intelligible though they are, and severally seeming to their respective adherents quite rational, turn out when critically examined to be literally unthinkable. It is not a question of probability or credibilty, but of conceivability. Experiment proves that the elements of these hypotheses cannot even be put together in consciousness; and we can entertain them only as we entertain such pseud-ideas as a square fluid and a moral substance—only by abstaining from the endeavor to render them into thought."

In view of his great influence upon the thought of this age, it is only right that we should expose, if we can, the irrational postulates of Mr. Spencer's argument on the creation. The facts, if rightly viewed, will make it extremely probable that his conclusions are a result of a conflict of reason and imagination in his own mind. He admits that from the beginning of history, and in the rudest creeds as well as in the cosmogony now extent, that it is believed, as a result of experience in life, that the heavens and the earth might have been made somewhat after the manner in which a workman makes a piece of furniture or a house. And in this admission he contradicts his former position, viz. that: "'Experiment proves that the elements of these hypothesis cannot be put together in consciousness." To make sure of his position here are his words:

"Though the proceedings of a human artificer may vaguely symbolize a method after which the universe might be shaped, yet imagination of this method does not help us to solve the ultimate problem; namely, the origin of the material of which the universe consists. The artizan does not make the iron, wood or stone, he uses, but merely fashions and combines them. If we suppose suns, and planets, and satellites, and all they contain to have been smilarly formed by a 'Great Artificer,' we suppose merely that certain pre-existing elements were thus put together in their present arrangement. But whence the pre-existing elements? The production of matter out of nothing is the real mystery, which neither this simile nor any other enables us to conceive, and a simile which does not enable us to conceive this may as well be dispensed with."

Wild indeed is the imagination,
That gets ahead of all creation.

Now, let us shake free from all this meaningless verbosity of speech and come back to plain common sense. Is it possible that common sense, or even the most thorough going reason, can have anything to do with that unthinkable question of the creation of something out of nothing? To this I would say NO; and I would put it strong. Reason is purely a faculty of mind; it is only mind that thinks; mind can think only of things and nothing which can be put together in consciousness. Hence it is that reason can have nothing to do with the unthinkable beyond revealing its true character. Every word of our language means something which has grown out of human experience. Reason must proceed by inference upon such experience, upon sensible facts or things, for the simple reason that there is nothing else to proceed upon. When we think, we simply put together in consciousness, our mental concepts of these things or facts; using reason and knowledge as a guide in the strictly constructive process. Whatever we construct must be clearly comprehensible in every distinction, every detail, every relation, and therefore every thing; as required by the known order of nature. If it is not this, it is not thinkable; and so it has no place within the province of reason. The argument from sense experience is so clear and conclusive that no one can fail to understand it.

We are all familiar with things in life which recently had a beginning and which we call young or new, also things which have existed a longer time and which we call old. Many of the new or old things are known to have been created in the minds of men just as a carpenter plans and puts up a house. Every atom of the material used in all manufactured things has come from its natural source the earth. And is there any other source? It would be universally regarded as a sure symptom of insanity to think of producing or obtaining any form of building material out of nothing. There is nothing in human experience plainer than the fact that all created things are created by mind and out of existing material. It is therefore a perfectly rational inference to suppose that the universe was created by mind and out of existing material. If we can find clear evidence of design in the present form and physical activities of the universe, we then have a very conclusive justification for this inference.

So far we are on the solid ground of human reason and so far it is a simple line of inference or induction from all human experience. But now we are at the danger point where imagination makes his assault with a storm of questions about the great first cause, and about everything being possible with God no matter how impossible or unreasonable it may seem to us. And right here it seems has always been the weak spot in reason, for here it is that so many philosophers, preachers and students of the Bible have fallen. This point in their reason was not well fortified. This carpenter idea of the creation is too simple for the robust imagination. I have questioned a number of preachers on this subject and almost without exception they have expressed the belief that the universe was created by God and of course out of nothing. How could it be otherwise? The fact that we cannot understand such things, is not the fault of God's word, but of our understanding. To doubt it would be to impose a limit to the Almighty power. This is a frequent statement and it seems certain that those who adopt this view simply do so from a disinclination to think. To understand the word of God, or what the Word really is, we must use reason. The philosophers and preachers above all men should be rational. If we think of the multitudes of people who must be led, we can see the responsibility of those who lead. Every passage in the Bible or in any other book that seems unreasonable is doubtful.

To prove from common sense that all such ideas about the creation are pure results of imagination I will call attention to one of the clearest statements of a great truth bearing on this subject. I quote from Spencer's "First Principles," page 177.

"Our inability to conceive matter becoming non-existent, is immediately consequent on the nature of thought. Thought consists in the establishment of relations. There can be no relations established, and therefore nc thought framed, when one of the related terms is absent from consciousness. Hence it is impossible to think of something becoming nothing, for the same reason that it is impossible to think of nothing becoming something—the reason, namely, that nothing cannot become an object of consciousness. The annihilation of matter is unthinkable for the same reason that the creation of matter is unthinkable."

There is one wrong statement in the above quoted passage. He says "that nothing cannot become an object of consciousness." Thru all this work I have tried to make it plain that nothing, or empty space, is, and must be, an object of consciousness. But it would be hard to find a clearer presentment of an exceedingly important truth than that of the second sentence above. "Thought consists in the establishment of relations." When Mr. Spencer wrote this sentence his hand was guided by reason. When he failed to see that the nothing-something or space-matter relation is the most fundamental and most important distinction in philosophy, his hand was guided by imagination. What a pity he did not follow the line of reason once he was on it, and so spare the world that muddling, brain-busting "Philosophy of the Unknowable." Let us begin where he went astray and see how we come out.

This is truly a question of relations; the first and deepest of which is the relations of nothing to something. Any man can think of a place, or a point in space, which contains nothing;

and in so doing he is simply thinking of empty space. "Without matter or mind, space would be nothing in the most ultimate sense. In the presence of the conscious mind and of the changing forms of matter, it is an object of consciousness." (§9). If creation is a change of nothing into something then of course it is unthinkable, and as said before reason can have nothing to do with it for every possible step in any process of reason must be perfectly clear and thinkable. If it is not it is not reason. As already (§1), shown, consciousness or thought, must always be of things and nothing, and every thing is a thing, (1), by reason of its difference from other things and nothing, (2), by reason of its relations to other things and nothing, and (3), by reason of the fact that there is an universal substance, called matter, and in which it was hecessary to create difference in order to create things.

If creation is not a change of nothing into something then what is it? Here is a chance for reason. We will ask a few simple questions that any ordinary person might ask, and let reason answer. And here let me add that these answers are not merely my opinion as to what creation is, but my opinion as to what the ordinary judgment or reason would be on the subject.

We: Does anything exist at present?

Reason: Yes, of course.

We: What is it?

Reason: The Universe; the heavens, the earth and all things.

We: How do you know?

Reason: Self-consciousness. Sense experience. Reason.

We: Who made the Universe and all it contains?

Reason: God, man and the other animals—the highest, wisest and most powerful individual Mind, and the lesser individuals who inhabit the planets.

We: What was the Universe made out of?

Reason: Matter, Motion and Mind.

We: What was matter, motion and mind made out of?

Reason: They were not made at all. Matter, motion, mind, are both indestructible and uncreatable. Matter is the substance of the Universe—the only space occupant. Motion is the motion of matter. Mind is the universal Property of matter by reason of which matter may be conscious or unconscious, and which opposites are states of mind. God is the Universal Individual whose body is all matter and who controls the whole as we control a part, and we and the rest of the folks are the lesser individuals who live on the planets and who try to manage our own bodies and our own affairs in the same way that God manages the Universe. But we do not do it as well as he does because we do not know how, and this we have to learn and let us be thankful that we have the opportunity. When we have learned the true relations of mind and matter within the small sphere of our own brain we shall then be at the point where we can understand the true relationship of God and this Material Universe. (§18, book 2.) When we understand the moral law as set forth in the Christian Gospel and when we are able to live up to it, we have then gained the highest goal of humanity. (§58, book 2.)

We: Well, then, what is creation?

Reason: Creation is change of form. All newly created things are new forms of matter, motion or mind, and mind is the creator and the only force.

We: But the philosophers tell us that the self-existence or eternal existence of matter is unthinkable; "that to conceive existence through infinite past time implies the conception of infinite past time, which is impossible."

Reason: But reason declares positively, with an open field all her own, that something now exists; and that it is unreasonable to think that somthing has produced itself out of nothing. So what are we going to do? Simply this. If reason is our guide, and if the Universe now exists, then the Universe has always existed, and the question is settled according to reason.

We: Well, when we look at it that way the view seems right and so it appears that reason for once has got ahead of imagination. No doubt it is true that we cannot easily grasp the idea of an eternal past and future existence, if we trust to imagination alone; yet it seems that our imagination does not interfere very much with our hopes for a future eternal life if we do the right in this life. But it is a sure thing that when we reason our way to it, the belief in the eternal duration of the Universe is perfectly satisfying. What is altogether reasonable must be true and we have a far safer ground for our belief in a future eternal life, in this rational belief than any other. This indeed is the true foundation of our Science of the Future Life. God is Life, and He is Eternal. To gain the life eternal is to become a part of Him, and the way is plainly set forth in the Moral Law. The way is not hard to find, indeed there is no other way in which human beings can be united under the most agreeable relations.

But we must not forget that imagination is one of the indispensables in the evolution of man. It is simply that imperfect form of reason which becomes perfect thru experience. But as the mind gains perfection in reason its sphere of action is confined more and more to lines of truth, and so it may lose many of its attractive objects of thought. The joys and sorrows that make life interesting by making it possible to hope for future good, and even poetry and music to some extent are dependant upon it, as necessary to the growing childhood of the race.

In the music of words we can rusticate,
When our minds are attuned to imaginate.

And while we rusticate let us hold fast to the truth that there is nothing that stands out plainer in human experience, nothing better supported by human reason and even nothing more clearly justified by the so called divine revelation, than this much neglected much abused yet most reasonable carpenter theory of the creation. In all past time and in all the future, there was and will be, a fundamental reality of Matter, Motion, Mind; which was not created and which cannot cease to exist. Universal change in this reality guided by mind, brings forth all created things, in the only correct sense of the word.

6. While setting the type for page 200 of this book I noticed in the Denver Public Library, a copy of "Modern Views of Electricity" (second edition) by Oliver J. Lodge. I have reviewed this book in §43 page 201. In an appendix to this book I have found certain quotations from Sir Isaac Newton's "Optics," which plainly show that Newton entertained views regarding the ether medium and the part it plays in light, heat, sound and gravitation, much like my own. I quote.—

"Q. 17. If a stone be thrown into stagnate water, the waves excited thereby continue some time to arise in the place where the stone fell into the water, and are propagated from thence in concentric circles upon the surface of the water to great distances. And the vibrations or tremors excited in the air by percussion, continue a little time to move from the place of percussion in concentric spheres to great distance. And in like manner, when a ray of light falls upon the surface of any pellucid body, and is there refracted or reflected, may not waves of vibrations or tremors be thereby excited in the refracting or reflecting medium at the point of incidence?"

"Q. 18. If in two large tall cylindrical vessels of glass inverted, two little thermometers be suspended so as not to touch the vessel, and the air be drawn out of one of these vessels and these vessels thus prepared be carried out of a cold place into a warm one; the thermometer in vacuo will grow warm as much and almost as soon as the thermometer which is not in vacuo. And when the vessels are carried back into the cold place, the thermometer in vacuo will grow cold almost as soon as the other thermometer. Is not the heat of the warm room conveyed through the vacuum by the vibrations of a much subtiler medium than air, which, after the air was drawn out remained in the vacuum? And is not this medium the same with that medium by which light is refacted and reflected, and by whose vibrations light communicates heat to bodies, and is put into fits of easy reflection and easy transmission? And do not the vibrations of this medium in hot bodies contribute to the intenseness and duration of their heat! And do not hot bodies communicate their heat to contiguous cold ones, by the vibrations of this medium propagated from them into the cold ones? And is not this medium exceedingly more rare and subtile than the air, and exceedingly more elastic and active? And doth it not readily pervade all bodies? And is it not (by its elastic force) expanded through all the heavens?"

"Q. 19. Doth not the refraction of light proceed from the different densities of this ethereal medium in different places, the light receding away from the denser parts of the medium? And is not the density thereof greater in free and open space, void of air and other gaseous bodies, than within the pores of water, glass, crystal, gems, and other compact bodies?"

"Q. 21. Is not this medium much rarer in the denser bodies of the sun, stars, planets, and comets, than in the empty celestial space between them? And in passing from them to great distances, doth it not grow denser perpetualy, and thereby cause the gravity of those great bodies towards one another, and of their parts towards the bodies; every body endeavoring to go from the denser parts of the medium towards the rarer? For if this medium be rarer within the sun's body than at its surface, and rarer there than at the hundredth part of an inch from its body, and rarer there than at the fiftieth of an inch from its body, and rarer there than at the orb of Saturn; I see no reason why the increase of density should stop anywhere, and not rather be continued through all distances from the sun to Saturn, and beyond. And though this increase of density may, at great distance be exceeding slow, yet if the elastic force of the medium be exceeding great, it may suffice to impel bodies from the denser parts of the medium towards the rarer with all that power which we call Gravity. And that the elastic force of the medium is exceeding great, may be gathered from the swiftness of its vibrations. Sound moves about 1140 English feet in a second minute of time, and in seven or eight minutes of time they move about one hundred English miles. Light moves from the sun to us in about seven or eight minutes of time, which distance is about 70,000,000 English miles, supposing the horizontal parallax of the sun to be about 12''. And the vibrations or pulses of this medium, that they may cause the alternate fits of easy transmission and easy reflection, must be swifter than light, and by consequence about 700,000 times swifter than sound. And therefore the elastic force of this medium in proportion to its density, must be about 700,000 X 700,000 times (that is, above 490,000,000,000) times greater than this elastic force of air is in proportion to its density. For the velocities of the pulses of elastic mediums are in a subduplicate ratio of the elasticities and the rarities of the mediums taken together."

"Q. 22. May not planets and comets, and all gross bodies, perform their motions more freely, and with less resistance in this etherial medium than in any fluid, which fills all space adequately without leaving any pores, and by consequence is much denser than quick-silver and gold? And may not its resistance be so small as to be inconsiderable? For instance; if this Ether (for so I will call it) should be supposed 700,000 times more elastic than our air, and above 700,000 times more rare; its resistance would be about 600,000,000 times less than that of water. And so small a resistance would scarce make a sensible alteration in the motion of the planets in ten thousand years. If any one would ask me how a medium can be so rare, let him tell me how the air in the upper parts of the atmosphere can be above an hundred thousand times rarer than gold. Let him also tell me how an electric body can by friction emit an exhalation so rare and subtile, and yet so potent, as by its emission to cause no sensible diminution of the weight of the electric body, and to be expanded through a sphere whose diameter is above two feet, and yet to be able to agitate and carry up leaf copper, or leaf gold, at the distance of above a foot from the electric body? And how the effluvia of a magnet can be so rare and subtile, as to pass through a plate of glass without any resistance or diminution of their force, and yet so potent as to turn a magnetic needle beyond the glass?"

The above quoted passages have been called "Newton's guesses concerning the ether." It seems to me that we might rightly call them very good examples of Human Reason; speculative perhaps but none the less rational so far as they go since they are well supported by experience. These questions were written down about 250 years ago, when very few people would admit the existence of an ether medium. But from that time to the present every right step in the advance of Physical Science has been possible only under the assumption that such a medium exists. In view of the fact that Newton, with Brewster, Biot, Laplace, Malus and other leading scientists of that day, upheld the Emission Theory of Light, and in view of the fact that this theory has since been completely demolished and replaced by the Wave Theory of Light, due to the labors of Huyghens, Euler, and in particular Young and Fresnel, these speculations of Newton, as it seems to me, are exceedingly interesting. He was on the right track in spite of his preconceived bias in favor of the now exploded Emission Theory. Notice Q. 21. So far as it goes, Newton's guess seems right to me with this exception: The outward increasing density of the medium must stop somewhere. (§20). He offers no guess as to the cause of the difference of density at different points in the medium, and in Q. 22 he seems to think, as many others do even at the present day, that the ether is a continuous non-porous medium.

Did it ever occur to Newton or to any one else that a material medium capable of being the vehicle of wave motion, as in light, heat, electricity, sound etc., and the cause of the difference of pressure necessary to produce the effects of gravitation, gravity, electric attraction, magnetic attraction, chemical affinity etc., and possessing difference of density at different points and great elastic force as supposed by Newton, must be composed of ultimate and absolutely solid particles of inert matter substantially as described in §20? And moreover, did it ever occur to any one that such a medium must be limited in space and bounded on the outside by a perfectly solid shell which is capable of resisting the enormous expansive energy from within? And fiinally, did it ever occur to any one that by admitting these postulates it is possible to explain and reduce to order every fact and mystery of the physical universe?

7. As announced in the preface my object in these books is to contribute something toward a solution of the problem of life. After treating the entire work both on its physical and mental sides, it has been found that the subject-matter which properly belongs to the mental side is much greater in volume than that of the physical side. Hence it has seemed best to add two chapters to this book which might find a more befitting place at the end of book 2. In the next two chapters the outlook for a World Christian Democracy, has deen considered.

CHAPTER EIGHTH.

RELIGION AND SCIENCE, PAST AND PRESENT.

The people are really beginning to think of the future of the human race on this planet. It is now freely admitted that the old aristocracies of birth and inherited wealth are passing away and a new time of progress in which minds that look beyond the present are thinking more of social conditions and of how to make life safer and more consonant with that of a true humanity. The world moves and many can see it but not all.

Fifty years ago the relations of Religion and Science were strained to the utmost. When the doctrine of Universal Evolution as promoted by Lamarck in France, Haeckel in Germany and Darwin, Spencer, Huxley and Tyndall in England, began to attract general attention, the defenders of the Christian faith were aroused at once and the leading magazines of the world were replete with frenzied controversy. Now see the difference. Preachers, Sociologists and other are saying things to-day that they would not think or dare to say fifty years ago. Instead of opposing Evolution, they are beginning to admit that Religion itself is Evolutionary. At least many of then are saying that there are changes going on in Religion and Society generally, of a progressive nature. They can see that in the history of all things, social or religious, there is a gradual but clearly marked advance from a rudimentarry and necessarily imperfect condition to a higher and more perfect condition. It is true that the range of human thought is widening and the Preachers are taking notice. Men are thinking more of material things and of the present as a guide to the future and the better things of life. Traditionalism is getting monotonous, and worse, it may not be true.

From a large number of press clippings I have selected a few on the various phases of this subject, which ought to afford satisfactory evidence as to the present trend of the more thorough going public mind. They are copied below.

"Christianity is nothing if not a Spirit. The kingdom of God is nowhere if not within us. We shall enter on no heaven that is not already begun in our hearts. We shall find no hell that does not have its prophecy in the experiences and possibilities of our inner life." Dr. Herrick Johnson, Chicago, Ill.

"I believe in the teachings of the Lord Jesus Christ and His apostles, contained in the New Testament, as I understand such teachings. They are less explicit on future punishment than on many or most other subjects. They make clear, however, that the incorrigibly wicked and rebellious finally cut themselves off from mercy, holiness and happiness. When that 'finally' is seems to be left undetermined. Material punishment is impossible for spiritual beings; the recognition of which fact accounts for the current lack of teaching of a sensuous penalty in the future life." Dr. Teunis S. Hamlin. Washington, D. C.

"That hell is a place of definite consignment and permanent retention of lost souls is to me unthinkable; indeed, the suggestion is so preposterous and in defiance to all the known facts of the universe, physical and spiritual, that I cannot understand the intellectual makeup of anyone who does believe this." Rev. Jenkins Lloyd Jones. Chicago, Ill.

"Science has given to the man of to-day a new heaven and a new earth in the way of enlarged conceptions of the stability of all its laws and processes. The man of science today is beyond measure better qualified for living a good life—useful to his fellows—than any man of 2000 years ago. He calls the forces of nature to his aid; he harnesses the streams to his whirring wheels and sends an invisible current of force through a wire to light a distant city or cook breakfast in a hundred houses. The fear of hell is still preached in the churches—in times of revivals—as though it were the sheet anchor of morality and the religious life." Rev. David Utter, Denver, Colo.

"Life is not a game of chance to be determined by the throwing of dice or the tossing of a penny. No, life is absolutely under its own control. By some compulsion, which we cannot understand, our lives seem to be driven hither and thither. In the face of this truth many are asking what part, if any, in God's plan do these constraining circumstances of life have? Much of life's deepest meaning and sweetest comfort centers in and about the answer to this question. * The coercions of earth that impel and compel us are but the outward expressions of God's hidden purpose. Great issues depend often upon some apparently small event. * Some people seem to believe that God finished His program in some remote past, while the fact remains that God is working out his plans here and now. All things are in a state of process. Man is still in the making; the world is still in the making. We see this constantly in the changes taking place in air and ocean currents and in the great earthquakes and disasters. God is not yet thru with this world. Some day we shall know that thru all the ages God was standing in the shadow keeping watch and that when we saw only a tangle of threads the Lord was at the loom." Rev. Joel F. Harper, Denver, Colo.

"Society has passed through the era of criticism and analysis and is now becoming creative. We have been in a hothouse condition for twenty years. We have analyzed the Bible and

Now, let us shake free from all this meaningless verbosity of speech and come back to plain common sense. Is it possible that common sense, or even the most thorough going reason, can have anything to do with that unthinkable question of the creation of something out of nothing? To this I would say NO; and I would put it strong. Reason is purely a faculty of mind; it is only mind that thinks; mind can think only of things and nothing which can be put together in consciousness. Hence it is that reason can have nothing to do with the unthinkable beyond revealing its true character. Every word of our language means something which has grown out of human experience. Reason must proceed by inference upon such experience, upon sensible facts or things, for the simple reason that there is nothing else to proceed upon. When we think, we simply put together in consciousness, our mental concepts of these things or facts; using reason and knowledge as a guide in the strictly constructive process. Whatever we construct must be clearly comprehensible in every distinction, every detail, every relation, and therefore every thing; as required by the known order of nature. If it is not this, it is not thinkable; and so it has no place within the province of reason. The argument from sense experience is so clear and conclusive that no one can fail to understand it.

We are all familiar with things in life which recently had a beginning and which we call young or new, also things which have existed a longer time and which we call old. Many of the new or old things are known to have been created in the minds of men just as a carpenter plans and puts up a house. Every atom of the material used in all manufactured things has come from its natural source the earth. And is there any other source? It would be universally regarded as a sure symptom of insanity to think of producing or obtaining any form of building material out of nothing. There is nothing in human experience plainer than the fact that all created things are created by mind and out of existing material. It is therefore a perfectly rational inference to suppose that the universe was created by mind and out of existing material. If we can find clear evidence of design in the present form and physical activities of the universe, we then have a very conclusive justification for this inference.

So far we are on the solid ground of human reason and so far it is a simple line of inference or induction from all human experience. But now we are at the danger point where imagination makes his assault with a storm of questions about the great first cause, and about everything being possible with God no matter how impossible or unreasonable it may seem to us. And right here it seems has always been the weak spot in reason, for here it is that so many philosophers, preachers and students of the Bible have fallen. This point in their reason was not well fortified. This carpenter idea of the creation is too simple for the robust imagination. I have questioned a number of preachers on this subject and almost without exception they have expressed the belief that the universe was created by God and of course out of nothing. How could it be otherwise? The fact that we cannot understand such things, is not the fault of God's word, but of our understanding. To doubt it would be to impose a limit to the Almighty power. This is a frequent statement and it seems certain that those who adopt this view simply do so from a disinclination to think. To understand the word of God, or what the Word really is, we must use reason. The philosophers and preachers above all men should be rational. If we think of the multitudes of people who must be led, we can see the responsibility of those who lead. Every passage in the Bible or in any other book that seems unreasonable is doubtful.

To prove from common sense that all such ideas about the creation are pure results of imagination I will call attention to one of the clearest statements of a great truth bearing on this subject. I quote from Spencer's "First Principles," page 177.

"Our inability to conceive matter becoming non-existent, is immediately consequent on the nature of thought. Thought consists in the establishment of relations. There can be no relations established, and therefore nc thought framed, when one of the related terms is absent from consciousness. Hence it is impossible to think of something becoming nothing, for the same reason that it is impossible to think of nothing becoming something—the reason, namely, that nothing cannot become an object of consciousness. The annihilation of matter is unthinkable for the same reason that the creation of matter is unthinkable."

There is one wrong statement in the above quoted passage. He says "that nothing cannot become an object of consciousness." Thru all this work I have tried to make it plain that nothing, or empty space, is, and must be, an object of consciousness. But it would be hard to find a clearer presentment of an exceedingly important truth than that of the second sentence above. "Thought consists in the establishment of relations." When Mr. Spencer wrote this sentence his hand was guided by reason. When he failed to see that the nothing-something or space-matter relation is the most fundamental and most important distinction in philosophy, his hand was guided by imagination. What a pity he did not follow the line of reason once he was on it, and so spare the world that muddling, brain-busting "Philosophy of the Unknowable." Let us begin where he went astray and see how we come out.

This is truly a question of relations; the first and deepest of which is the relations of nothing to something. Any man can think of a place, or a point in space, which contains nothing;

and in so doing he is simply thinking of empty space. "Without matter or mind, space would be nothing in the most ultimate sense. In the presence of the conscious mind and of the changing forms of matter, it is an object of consciousness." (§9). If creation is a change of nothing into something then of course it is unthinkable, and as said before reason can have nothing to do with it for every possible step in any process of reason must be perfectly clear and thinkable. If it is not it is not reason. As already (§1), shown, consciousness or thought, must always be of things and nothing, and every thing is a thing, (1), by reason of its difference from other things and nothing, (2), by reason of its relations to other things and nothing, and (3), by reason of the fact that there is an universal substance, called matter, and in which it was hecessary to create difference in order to create things.

If creation is not a change of nothing into something then what is it? Here is a chance for reason. We will ask a few simple questions that any ordinary person might ask, and let reason answer. And here let me add that these answers are not merely my opinion as to what creation is, but my opinion as to what the ordinary judgment or reason would be on the subject.

We: Does anything exist at present?

Reason: Yes, of course.

We: What is it?

Reason: The Universe; the heavens, the earth and all things.

We: How do you know?

Reason: Self-consciousness. Sense experience. Reason.

We: Who made the Universe and all it contains?

Reason: God, man and the other animals—the highest, wisest and most powerful individual Mind, and the lesser individuals who inhabit the planets.

We: What was the Universe made out of?

Reason: Matter, Motion and Mind.

We: What was matter, motion and mind made out of?

Reason: They were not made at all. Matter, motion, mind, are both indestructible and uncreatable. Matter is the substance of the Universe—the only space occupant. Motion is the motion of matter. Mind is the universal Property of matter by reason of which matter may be conscious or unconscious, and which opposites are states of mind. God is the Universal Individual whose body is all matter and who controls the whole as we control a part, and we and the rest of the folks are the lesser individuals who live on the planets and who try to manage our own bodies and our own affairs in the same way that God manages the Universe. But we do not do it as well as he does because we do not know how, and this we have to learn and let us be thankful that we have the opportunity. When we have learned the true relations of mind and matter within the small sphere of our own brain we shall then be at the point where we can understand the true relationship of God and this Material Universe. (§18, book 2.) When we understand the moral law as set forth in the Christian Gospel and when we are able to live up to it, we have then gained the highest goal of humanity. (§58, book 2.)

We: Well, then, what is creation?

Reason: Creation is change of form. All newly created things are new forms of matter, motion or mind, and mind is the creator and the only force.

We: But the philosophers tell us that the self-existence or eternal existence of matter is unthinkable; "that to conceive existence through infinite past time implies the conception of infinite past time, which is impossible."

Reason: But reason declares positively, with an open field all her own, that something now exists; and that it is unreasonable to think that somthing has produced itself out of nothing. So what are we going to do? Simply this. If reason is our guide, and if the Universe now exists, then the Universe has always existed, and the question is settled according to reason.

We: Well, when we look at it that way the view seems right and so it appears that reason for once has got ahead of imagination. No doubt it is true that we cannot easily grasp the idea of an eternal past and future existence, if we trust to imagination alone; yet it seems that our imagination does not interfere very much with our hopes for a future eternal life if we do the right in this life. But it is a sure thing that when we reason our way to it, the belief in the eternal duration of the Universe is perfectly satisfying. What is altogether reasonable must be true and we have a far safer ground for our belief in a future eternal life, in this rational belief than any other. This indeed is the true foundation of our Science of the Future Life. God is Life, and He is Eternal. To gain the life eternal is to become a part of Him, and the way is plainly set forth in the Moral Law. The way is not hard to find, indeed there is no other way in which human beings can be united under the most agreeable relations.

But we must not forget that imagination is one of the indispensables in the evolution of man. It is simply that imperfect form of reason which becomes perfect thru experience. But as the mind gains perfection in reason its sphere of action is confined more and more to lines of truth, and so it may lose many of its attractive objects of thought. The joys and sorrows that make life interesting by making it possible to hope for future good, and even poetry and music to some extent are dependant upon it, as necessary to the growing childhood of the race.

In the music of words we can rusticate,
When our minds are attuned to imaginate.

And while we rusticate let us hold fast to the truth that there is nothing that stands out plainer in human experience, nothing better supported by human reason and even nothing more clearly justified by the so called divine revelation, than this much neglected much abused yet most reasonable carpenter theory of the creation. In all past time and in all the future, there was and will be, a fundamental reality of Matter, Motion, Mind; which was not created and which cannot cease to exist. Universal change in this reality guided by mind, brings forth all created things, in the only correct sense of the word.

6. While setting the type for page 200 of this book I noticed in the Denver Public Library, a copy of "Modern Views of Electricity" (second edition) by Oliver J. Lodge. I have reviewed this book in §43 page 201. In an appendix to this book I have found certain quotations from Sir Isaac Newton's "Optics," which plainly show that Newton entertained views regarding the ether medium and the part it plays in light, heat, sound and gravitation, much like my own. I quote.—

"Q. 17. If a stone be thrown into stagnate water, the waves excited thereby continue some time to arise in the place where the stone fell into the water, and are propagated from thence in concentric circles upon the surface of the water to great distances. And the vibrations or tremors excited in the air by percussion, continue a little time to move from the place of percussion in concentric spheres to great distance. And in like manner, when a ray of light falls upon the surface of any pellucid body, and is there refracted or reflected, may not waves of vibrations or tremors be thereby excited in the refracting or reflecting medium at the point of incidence?"

"Q. 18. If in two large tall cylindrical vessels of glass inverted, two little thermometers be suspended so as not to touch the vessel, and the air be drawn out of one of these vessels and these vessels thus prepared be carried out of a cold place into a warm one; the thermometer in vacuo will grow warm as much and almost as soon as the thermometer which is not in vacuo. And when the vessels are carried back into the cold place, the thermometer in vacuo will grow cold almost as soon as the other thermometer. Is not the heat of the warm room conveyed through the vacuum by the vibrations of a much subtiler medium than air, which, after the air was drawn out remained in the vacuum? And is not this medium the same with that medium by which light is refacted and reflected, and by whose vibrations light communicates heat to bodies, and is put into fits of easy reflection and easy transmission? And do not the vibrations of this medium in hot bodies contribute to the intenseness and duration of their heat! And do not hot bodies communicate their heat to contiguous cold ones, by the vibrations of this medium propagated from them into the cold ones? And is not this medium exceedingly more rare and subtile than the air, and exceedingly more elastic and active? And doth it not readily pervade all bodies? And is it not (by its elastic force) expanded through all the heavens?"

"Q. 19. Doth not the refraction of light proceed from the different densities of this ethereal medium in different places, the light receding away from the denser parts of the medium? And is not the density thereof greater in free and open space, void of air and other gaseous bodies, than within the pores of water, glass, crystal, gems, and other compact bodies?"

"Q. 21. Is not this medium much rarer in the denser bodies of the sun, stars, planets, and comets, than in the empty celestial space between them? And in passing from them to great distances, doth it not grow denser perpetualy, and thereby cause the gravity of those great bodies towards one another, and of their parts towards the bodies; every body endeavoring to go from the denser parts of the medium towards the rarer? For if this medium be rarer within the sun's body than at its surface, and rarer there than at the hundredth part of an inch from its body, and rarer there than at the fiftieth of an inch from its body, and rarer there than at the orb of Saturn; I see no reason why the increase of density should stop anywhere, and not rather be continued through all distances from the sun to Saturn, and beyond. And though this increase of density may, at great distance be exceeding slow, yet if the elastic force of the medium be exceeding great, it may suffice to impel bodies from the denser parts of the medium towards the rarer with all that power which we call Gravity. And that the elastic force of the medium is exceeding great, may be gathered from the swiftness of its vibrations. Sound moves about 1140 English feet in a second minute of time, and in seven or eight minutes of time they move about one hundred English miles. Light moves from the sun to us in about seven or eight minutes of time, which distance is about 70,000,000 English miles, supposing the horizontal parallax of the sun to be about 12". And the vibrations or pulses of this medium, that they may cause the alternate fits of easy transmission and easy reflection, must be swifter than light, and by consequence about 700,000 times swifter than sound. And therefore the elastic force of this medium in proportion to its density, must be about 700,000 X 700,000 times (that is, above 490,000,000,000) times greater than this elastic force of air is in proportion to its density. For the velocities of the pulses of elastic mediums are in a subduplicate ratio of the elasticities and the rarities of the mediums taken together."

"Q. 22. May not planets and comets, and all gross bodies, perform their motions more freely, and with less resistance in this etherial medium than in any fluid, which fills all space adequately without leaving any pores, and by consequence is much denser than quick-silver and gold? And may not its resistance be so small as to be inconsiderable? For instance; if this Ether (for so I will call it) should be supposed 700,000 times more elastic than our air, and above 700,000 times more rare; its resistance would be about 600,000,000 times less than that of water. And so small a resistance would scarce make a sensible alteration in the motion of the planets in ten thousand years. If any one would ask me how a medium can be so rare, let him tell me how the air in the upper parts of the atmosphere can be above an hundred thousand times rarer than gold. Let him also tell me how an electric body can by friction emit an exhalation so rare and subtile, and yet so potent, as by its emission to cause no sensible diminution of the weight of the electric body, and to be expanded through a sphere whose diameter is above two feet, and yet to be able to agitate and carry up leaf copper, or leaf gold, at the distance of above a foot from the electric body? And how the effluvia of a magnet can be so rare and subtile, as to pass through a plate of glass without any resistance or diminution of their force, and yet so potent as to turn a magnetic needle beyond the glass?"

The above quoted passages have been called "Newton's guesses concerning the ether." It seems to me that we might rightly call them very good examples of Human Reason; speculative perhaps but none the less rational so far as they go since they are well supported by experience. These questions were written down about 250 years ago, when very few people would admit the existence of an ether medium. But from that time to the present every right step in the advance of Physical Science has been possible only under the assumption that such a medium exists. In view of the fact that Newton, with Brewster, Biot, Laplace, Malus and other leading scientists of that day, upheld the Emission Theory of Light, and in view of the fact that this theory has since been completely demolished and replaced by the Wave Theory of Light, due to the labors of Huyghens, Euler, and in particular Young and Fresnel, these speculations of Newton, as it seems to me, are exceedingly interesting. He was on the right track in spite of his preconceived bias in favor of the now exploded Emission Theory. Notice Q. 21. So far as it goes, Newton's guess seems right to me with this exception: The outward increasing density of the medium must stop somewhere. (§20). He offers no guess as to the cause of the difference of density at different points in the medium, and in Q. 22 he seems to think, as many others do even at the present day, that the ether is a continuous non-porous medium.

Did it ever occur to Newton or to any one else that a material medium capable of being the vehicle of wave motion, as in light, heat, electricity, sound etc., and the cause of the difference of pressure necessary to produce the effects of gravitation, gravity, electric attraction, magnetic attraction, chemical affinity etc., and possessing difference of density at different points and great elastic force as supposed by Newton, must be composed of ultimate and absolutely solid particles of inert matter substantially as described in §20? And moreover, did it ever occur to any one that such a medium must be limited in space and bounded on the outside by a perfectly solid shell which is capable of resisting the enormous expansive energy from within? And fiinally, did it ever occur to any one that by admitting these postulates it is possible to explain and reduce to order every fact and mystery of the physical universe?

7. As announced in the preface my object in these books is to contribute something toward a solution of the problem of life. After treating the entire work both on its physical and mental sides, it has been found that the subject-matter which properly belongs to the mental side is much greater in volume than that of the physical side. Hence it has seemed best to add two chapters to this book which might find a more befitting place at the end of book 2. In the next two chapters the outlook for a World Christian Democracy, has deen considered.

CHAPTER EIGHTH.

RELIGION AND SCIENCE, PAST AND PRESENT.

The people are really beginning to think of the future of the human race on this planet. It is now freely admitted that the old aristocracies of birth and inherited wealth are passing away and a new time of progress in which minds that look beyond the present are thinking more of social conditions and of how to make life safer and more consonant with that of a true humanity. The world moves and many can see it but not all.

Fifty years ago the relations of Religion and Science were strained to the utmost. When the doctrine of Universal Evolution as promoted by Lamarck in France, Haeckel in Germany and Darwin, Spencer, Huxley and Tyndall in England, began to attract general attention, the defenders of the Christian faith were aroused at once and the leading magazines of the world were replete with frenzied controversy. Now see the difference. Preachers, Sociologists and other are saying things to-day that they would not think or dare to say fifty years ago. Instead of opposing Evolution, they are beginning to admit that Religion itself is Evolutionary. At least many of then are saying that there are changes going on in Religion and Society generally, of a progressive nature. They can see that in the history of all things, social or religious, there is a gradual but clearly marked advance from a rudimentarry and necessarily imperfect condition to a higher and more perfect condition. It is true that the range of human thought is widening and the Preachers are taking notice. Men are thinking more of material things and of the present as a guide to the future and the better things of life. Traditionalism is getting monotonous, and worse, it may not be true.

From a large number of press clippings I have selected a few on the various phases of this subject, which ought to afford satisfactory evidence as to the present trend of the more thorough going public mind. They are copied below.

"Christianity is nothing if not a Spirit. The kingdom of God is nowhere if not within us. We shall enter on no heaven that is not already begun in our hearts. We shall find no hell that does not have its prophecy in the experiences and possibilities of our inner life." Dr. Herrick Johnson, Chicago, Ill.

"I believe in the teachings of the Lord Jesus Christ and His apostles, contained in the New Testament, as I understand such teachings. They are less explicit on future punishment than on many or most other subjects. They make clear, however, that the incorrigibly wicked and rebellious finally cut themselves off from mercy, holiness and happiness. When that 'finally' is seems to be left undetermined. Material punishment is impossible for spiritual beings; the recognition of which fact accounts for the current lack of teaching of a sensuous penalty in the future life." Dr. Teunis S. Hamlin. Washington, D. C.

"That hell is a place of definite consignment and permanent retention of lost souls is to me unthinkable; indeed, the suggestion is so preposterous and in defiance to all the known facts of the universe, physical and spiritual, that I cannot understand the intellectual makeup of anyone who does believe this." Rev. Jenkins Lloyd Jones. Chicago, Ill.

"Science has given to the man of to-day a new heaven and a new earth in the way of enlarged conceptions of the stability of all its laws and processes. The man of science today is beyond measure better qualified for living a good life—useful to his fellows—than any man of 2000 years ago. He calls the forces of nature to his aid; he harnesses the streams to his whirring wheels and sends an invisible current of force through a wire to light a distant city or cook breakfast in a hundred houses. The fear of hell is still preached in the churches—in times of revivals—as though it were the sheet anchor of morality and the religious life." Rev. David Utter, Denver, Colo.

"Life is not a game of chance to be determined by the throwing of dice or the tossing of a penny. No, life is absolutely under its own control. By some compulsion, which we cannot understand, our lives seem to be driven hither and thither. In the face of this truth many are asking what part, if any, in God's plan do these constraining circumstances of life have? Much of life's deepest meaning and sweetest comfort centers in and about the answer to this question. * The coercions of earth that impel and compel us are but the outward expressions of God's hidden purpose. Great issues depend often upon some apparently small event. * Some people seem to believe that God finished His program in some remote past, while the fact remains that God is working out his plans here and now. All things are in a state of process. Man is still in the making; the world is still in the making. We see this constantly in the changes taking place in air and ocean currents and in the great earthquakes and disasters. God is not yet thru with this world. Some day we shall know that thru all the ages God was standing in the shadow keeping watch and that when we saw only a tangle of threads the Lord was at the loom." Rev. Joel F. Harper, Denver, Colo.

"Society has passed through the era of criticism and analysis and is now becoming creative. We have been in a hothouse condition for twenty years. We have analyzed the Bible and dogmatized the Bible and have had heresy trials that were more dangerous than Chicago fires and we have asked questions and answered them. We have passed from the old thought that the world was created in six days to the new thought that God is making a new world every moment. At length we understand that God is not far off, that He is not to interrupt our laws with miracles, but that He is close to men and is living with him all the time. All this is the result of Science. We are at the beginning of the greatest church going epoch in all history." Rev. Dr. Newell Dwight Hillis, Brooklyn, N. Y.

"The greatest miracle in history is Jesus. The most significant factor in civilization is the abiding influence of the living man from calvary. His was an unique personality. He lived in an age of rampant materialism and bigoted sacerdotalism but he was neither a materialist nor sacerdotalist. In the throbing life of his day he stood out as the unique and extraordinary exception to the universal law of heredity and environment. For 2000 years the mental and moral character of the man from calvary has been critically dissented and remains the single expression of a perfectly poised and spotless personality. And Jesus came to establish a world religion. He found in the world a religion steeped in traditionalism, legalistic, dogmatic. He gave to the world a religion as fresh as the mountain breezes that blow at the break of day. It was not his purpose to establish a religious cult or national church or ecclesiastical hierarchy. It was his purpose to infuse into the heart of humanity the spirit of peace and love and good will. His religion is marked by an absence of sectional or racial or national barriers. The issue is spiritual. The ultimate implication is the dynamic transformation of society." Rev. Ingram E. Bill, Denver, Colo.

"It is my belief that we are now in process of a religious transition farther reaching in its issues than was the Reformation of the sixteenth century. It is a movement that is worldwide and comprehends all circles of life. While it is the operation of the spirit of God, its manifestation is as marked outside the church as it is within. This phenomena is perplexing, I am sorry to say, to many ecclesiastical leaders, who feel that religious fervor should be confined to channels prescribed for it in past ages. Christianity has outgrown its older forms and is expressing itself in social, industrial, political and other human activities. The movement is characterized by the desire and demand that all divine qualities revered and worshiped in God and Christ, now and during former ages, shall become operative in men, and shall be dominant in their social relations. Men still believe in the righteousnes of God, but today they want it translated from God into business men, and into state and city officials. Divine justice must become incarnate in employers of men and in those who are employed. There is no less mercy in heaven but men believe that this must prevail on earth as in heaven. The life and teachings of Jesus Christ will be accepted with a seriousness beyond that of any previous age, and the pledge of this seriousness will be not only doctrinal statements and fervent worship, but the living every day and in every relation, of the same mind and spirit which was in Him. We are entering an age when Christ principle, as a principle incarnate in man, is to have recognition and dominion." Rev. David H. Fouse, Denver, Colo.

"The church is in a transition stage. Just as the fight is on in the political and industrial world for the rights of the people and the realization in practic of the ideal of Democracy, (the government of the people, for and by the people) and the placing of the emphasis upon the man, rather than upon material or method, so it is on in the church for the right of individual interpretation of God's word, against human standards of authority and for majority rule against the manipulation of ecclesiastical machinery by those who stand for class rule and special privilege. In too many of our churches the people are patronized and governed by the few who constitute the moneyed element." Rev. W. S. Rudolph, Denver, Colo.

"America today is overchurched. * The day is coming when the Protestant church will be one. Though the movement may seem slow is it sure. Sectarian prejudices no longer hold ground with educated and enlightened persons, and creeds are slowly dying off the face of the earth. In that millenium when church unity has been attained, there will be but one church to a district—say of 2,500 or 3,000 persons. The poverty of the church today is caused by the fact that there are too many of them for the land. You go into a small place of two or three thousand inhabitants, like Golden, and you will find five or six struggling churches, where one could enjoy prosperity and amply satisfy the religious and social needs of the community." Rev. Dr. Robert F. Coyle, Denver, Colo.

The above extracts from sermons and interviews published in the newspapers within the last few years, are all from pastors of the several Protestant churches of this country. Two of these churches are in Chicago, Ill. one in Washington, D. C. one in Brooklyn, N. Y. and six in Denver, Colo. Those of Denver were printed in the "Rocky Mountain News" and the others in the "Kansas City Star." These quotations were selected from many others of like meaning. From the files of every leading newspaper in this country a similar batch of indictments of impotency against the church, might be compiled. All these opinions are from educated men, skilled in exegetics or scriptural interpretation and we can depend on what they say. I have quoted them because they have told the truth as I see it and they have told it better than I could. But they are not to be held responsible for anything I have said in this book. They are all total strangers to me and I have quoted them without asking permission because I could see no reason for it. One plain thing in these extracts, is, that all tell the same story with variations and different words. From which it must be inferred that the Bible is a questionable source of information on matters of religion and social welfare. If the Bible is literally true, then of course the only true religion must be a rigidly dogmatic religion as based on that book. If it is questionable, then we are at liberty to use our own reason, examine the book carefully in the light of recent knowledge and come to a decision as to what parts are true and what are not true. In this way a final judgment and perfect agreement is inevitable; simply because all enlightened men must agree when they know the whole truth. The religion of the savage is not the religion of the civilized man of today, yet all men were once in the savage state. That civilization is a thing of growth and that it is still growing, that growth is progress, development or evolution, no well informed person can doubt for a moment. We must say the same of all the activities of life, indeed life itself is progressive from the birth of the individual or race to its highest stage of development. What is religion if it is not that most essential phase of life which must keep pace with the intellectual development of man? What is religion if it is not that complex human sentiment of love, devotion, gratitude, reverence, feeling of dependence and hope for the future, towards an exalted and mysterious Being? and how is all this possible if it does not depend upon unquestionable knowledge? If religion is not this and if not justified in this way it is not religion. It is nothing but a dogmatic assumption like one of those articles of faith conceived in the brain of fallible man and designed to shape the thought and conduct of men who are moving for a higher and better life.

Another plain fact set forth in these extracts is the spiritual and religious significancy of the life and teachings of Jesus. We can justly criticize the Bible in many parts but we cannot criticize it in that part which contains the Christian gospel. And why? because it bears the imprint of scientific truth more decidedly than any other part of the book. It is true not because the Bible says so but because every one of its truths can be demonstrated by modern scientific method. In book 2, I will try to make it plain that all the so called miracles of Jesus come within the possibilities of mind and that there is nothing miraculous in them. They are all explained under universal laws of mind and to know this it is only necessary to push the study of mind to the limit. Perhaps the most notable thing in the life of Jesus was his matchless personality. (page 282) No other man in this world was like him in certain well marked respects. If he had lived in the present age with his wonderful psychic powers, and if he had possessed the mercenary spirit that most of our business men and women possess, he could have been several times a millionaire and even in his own day he could have been a very rich man. But this was not his mission; indeed every fact of his brief career on earth seems to prove his divine office. That story of his immaculate conception is most likely a myth, at least if true it would be contrary to Nature's law, all of which is God's law. He came into this world just as other men do but early in life he was initiated into that highest sphere of spirit life and became one with God. In the gospel record he often speaks of himself as being the son of man, also as being one with God. It is unquestionably true that he made no distinction between himself and others. What he could do others could do and what he was others could be. He made frequent use of the word faith or belief as necessary in his work and so made it clear that his power was that of mind—the one universal mind of God and all living thing. He set an example of right living and of how to make the best of this life, which no enlightened man can fail to understand and which certainly must bring peace and happiness to the entire world. He made it plain that all men can be like him—that it is only a matter of mental development or evolution and we can rest assured that modern scientific research will vindicate him as no other man in this world ever was.

The next quotations are from modern philosophers and university men who are taking some interest in religion and society.

"The church has to a considerable extent ceased to be the recognized moral leader of society. We have the strange spectacle of a great many religious people in the church who have no moral influence in society and of many men of moral influence who have nothing to do with the church. I think it must be admitted that there are tendencies in modern life that are clearly disturbing to personal religion. The four leading disturbing elements are the increased significance of material things, the changed atitude toward scriptural authority, the study of religion by a historical and scientific method as contrasted with a dogmatic method and the development of an ethical sentiment without a conscious dependence upon religion. There was a time when the church interpreted the Bible and prescribed to the individual the nature of his personal religion. A new attitude has come. The individual now looks within himself very carefully; he explores in regions the church has not prescribed. Many persons have become negligent toward religion because they have tested the methods of the church and have found that they did not work out as predicted. Men used to read the Bible, saying, 'what does it mean to me?' as though the thing they were reading was in the Bible for the purpose of promoting their personal religion. As a result of the new study the Bible has become a history. In consequence many persons find that the old glory of the scriptures has grown dim. In the old days religious consciousness and moral consciousness were one. Today a large proportion of the efforts to better the condition of humanity is undertaken with no distinct consciousness of a relation with religion. Moral enthusiasm has come to take the place of religious zeal."

But this philosopher takes an optimistic view of the outlook for the future of religion. He says in conclusion:

"The very same tendencies that today disturb personal religion are capable of promoting it. The old view of church authority interposed a barrier between the soul and God; the new idea removes that barrier. Within a short time we shall see in our Sunday schools the fruits of the modern method of scripture study, and personal religion will be promoted. The church must take the lead in the ethical movement of the time. She must show by her good works that she has all that the ethical people have and more. The time will come when the pulpit will dare to assert the right of Christ and of the church to the material wealth of church members." Prof. George A. Coe, Moral Philosophy, Northwestern University, Chicago, Ill.

It is my belief that the time will come when the preacher and the philosopher will be one. When the Bible has ceased to be the text book of religion, when man has come to the realization that his religion should be so large as to include his whole life, and when he can see that his own life is only a small part of the universal life without which he would not exist, then of course the office of expounder of religion and philosophy must be the same. There is very good reason to believe that Jesus himself was a philosopher—as much so as any one could be in his age of the world. His familiarity with the country and with plant and animal life is well shown in his parables and in other ways. And most of all in his humanitarian views of life.

"Christians are mostly as dead to nature as other men. 'We have the Bible,' they say, as if it were God's only communication to us. We continually dwell on Christ's bidding to 'search the Scriptures,' and we do well. But here is another of his commands, 'Consider the lilies,' and where is our authority for slighting this? Of course it is not an injunction in favor of the lilies as against other flowers—the rose, the marigold, the dahlia, the pansy, or against the useful plants which are so modest—but rather one which is meant to open our eyes upon God's works at large, bend us to the study of all nature as God's fundamental word." Chancellor E. Benjamin Andrews. Lincoln, Neb.

There is one notable feature of religion which should have some attention here. It is properly called Revivalism—an outburst of religious enthusiasm, generally due to some exciting cause and most effectual on excitable people. The revival has prevailed more or less in all the old religions from the earliest times to the present day, but it seems that they are less violent today than in former years. A Muhamadan revival aims for a return to the strict doctrines of the Koran and the participants are often seized with a desire to take the sword and massacre all the Christians in the neighborhood, if they happen to be in the minority. The Christians have been less severe in their revivals toward nonbelievers perhaps because Jesus plainly forbid the use of the sword. Many revivals have occurred among the Christians from apostolic times down to the present and they have been instrumental in bringing about many great reforms. Revivals of the present day seem to be confined to the Protestant churches and they do not aim to introduce anything new but only to revive or work up a spiritual enthusiasm for the old forms of religion. The means employed are exciting sermons, prayers for an outpouring of the Holy Spirit and daily and nightly meetings. It has been found that many of those converted remain steadfast in the faith while many others soon go back to the old habits of sin and the usual religious deadness returns. It has also been noticed that excitable persons are sometimes thrown into a state of ecstasy in which they shout, jump, utter piercing cries or fall prostrated on the floor.

The success of a revival always seems to depend on the man who leads. Perhaps one of the most succesful revivalists that ever traveled this country is the one who has just closed a series of meetings here in Denver. His name is William A. Sunday, Billy for short. I take what follows from observation and from the printed reports of his meetings.

Billy is a man of medium size, light complection, 51 years old, gray eyes, rather full face, nervous, evasive, and when in action often showing the fighting spirit with bull-dog tenacity. He got his early world training in the baseball field and among the men and boys of the street. Also that of the common school. He gave up baseball for the more lucrative employment of saving souls and here he has found the vocation for which he is well qualified, at least from the business view point. He plainly displays a degree of shrewd business cunning which ought to bring success in any pursuit. If there is such a thing as making a business of religion with a view to monetary success this man has got the trick to perfection. In Denver he converted 9,000 sinners and received $10,000 as a donation. In Des Moines, Ia, he converted 11,000 and received $12,844.02 as a free offering for his work. It is said that in other places he has received more than double these amounts. But how does he do it? Is it the spirit of God working thru this man as is claimed by many, or is it the spirit of Old Nick helping him to catch suckers? The hardened sinner or the confirmed devotee, both invulnerable to anything new, would see nothing in it. But let us briefly examine his modus of procedure. In the first place he preaches the old Jonathan Edwards, hotter than hell, style of sermon, interspersed with slang and vulgar wit. He preaches the gospel of Jesus in the language which he thinks is capable of driving it home to stay. He says: "I am condemned for my slang but it wins converts. I try to reach the man of the street whose talk is made up of one-third cuss words, one-third obscenity and one-third slang. I wouldn't use cuss words or obscenity, so I talk slang to him."

Billy entertains no bright hopes for the future of religion. He say: "There will always be wars and there must be according to the Bible. A man must go thru life fighting. God is the God of love and the God of war too. The Devil has supernatural power and I believe the Lord lets him go it just to see what he'll do. The world is fast going to the Devil. It's growing worse every day. It's much worse than it was ten years ago. Look how the people now go to the extremes. The women are as bad as the men. Look at the way they dress. I don't say it's immoral for a girl to go down town with her skirt slit up clear to her knee, but it may lead to immorality. I am no crank about dress. I like to see a women in neat up-to-date clothes, I never fancied those dresses with a lot of hooks up the back and mutton leg sleeves. There is nothing wrong about a girl wearing short sleeves and low neck, that is, if it is reasonably low. It's the women in society who drink cocktkails and smoke cigarettes that are helping to take the world to the devil. Other classes imitate them. That's where they do their harm."

In his sermons Billy talks much the same as he does in conversation and the above is a fair example of the subjects discused and of the way they are handled. He never attempts to consider any abstruse problem. Such discussions would not entertain the crowd and perhaps he would not be able to give them proper treatment. His strongest "punch," as he puts it, is in his slangy remarks, his thrusts of irony and his athletic leaps and facial grimaces while in action on the platform. Every point he makes is driven in and clinched by expressive movements of his whole body. Here are some hot ones right from his bat.

"I am not saying you can't be a good Christian and use tobacco, but I do say if you use it you're a mighty dirty one.

"If you must smoke use an old brier pipe; for, if you use cigarettes, you little fool, you'll wake up some morning with your brains runing out on your pillow.

"There are people so mean that they never give away ten cents without singing, 'God Be With You Till We Meet Again.' There are people so stingy they sing thru their nose to save the wear and tear on their false teeth. There are people who, when you ask them to sing, 'Old Hundred,' will sing the 'Ninty and Nine' to save the 1 per cent. There are people so mean they would steal flies from a blind spider."

He likes to wallop the women folks and they seem to like him all the better for it. He says:

"The most useless being on earth is the society woman.

"You can't raise the standard of morals by raising wages.

"It makes me sick to see a fool woman hugging and kissing a brindle-nosed pup. And let me suggest that perhaps that is why her husband is not more affectionate, for no real blooded man wants to play second fiddle to a bow-legged bulldog."

He fires them off like this, one after another, and the ten or or twelve thousand people assembled in the great wooden tabernacle are fairly convulsed with merriment. Some of them laugh so hard as to incur the danger of personal injury. With an eye to business he attempts no conversion work until he has got the crowd well worked up, which takes time. Besides his mirth provoking talks he has another way of stirring em' up, and this is by making a strong appeal to the imagination of fear. To this end he has a number of stories of death scenes which he tells to good effect. Here is one of them:

"And there you sit, without His salvation. You don't care for Him. Some of you like a dog or a horse better than you do Jesus. You have treated Him worse than a brute because you think more of brutes than you do of Him. You giggle in His presence, and some wicked thought is flashing thru your mind now, and you can hardly wait until I have finished so that you can creep away and propagate your iniquity. You are having damnation written on your soul this very minute while you sit there and wait. * Some of you are wearing mourning. That tells me that you have lost somebody out there that you wish was by your side now. That tells me that death has been down to where you live and has stopped in front of your house. Listen! Some day there will be another funeral and it will be on your street, and the hearse will stop in front of your house. Some day the pallbearers will come to carry out another body and you will be in the coffin and your name will be on the coffin plate and your name will be on the tombstone, and still there you sit. Say, listen- If God would just pull the curtain back and let some of you men and women see how close you are to the coffin you would turn pale. Some of you are so close to the hearse that if God would pull back the curtain you could reach out and touch it tonight. And there you sit without Jesus Christ as your Savior."

That such stories are deliberately told for an effect; that

that the effect is plainly evident to any careful observer, is beyond dispute. To see the would-be converts with pale anxious faces and some of them in tears, flocking to the salvation trough, is a sight to be remembered. It reminds me of the old days on the farm when I use to feed the pigs. With a bucket of slop I would go out to the trough and shout: 'pegoa, pegoa, then they would come on the run, squealing and falling over each other, from every part of the hog lot. They wanted something good and slop is a good thing for pigs.

But what does it all mean? If I attempt to answer this question my only resort is to use the ordinary judgment which every man has and which always proceeds on knowledge. It is plain that all these converts and all those who are in sympathy with them are very much in earnest. They believe what the evangelist says and many of them are visibly affected. A dominant mental element in them is passiveness; susceptibility to impressions from the outside due to deficiency of knowledge and self-control. They believe because they do not know any better and the poor things want to be saved. A simple case of the insanity of ignorance and they have all got it more or less. And the evangelist: he has got it too and he has got it bad. And he has got something else which marks a striking contrast between him and his converts. He exhibits a degree of arrogence and positive assumption which might be properly called contemptible insolence. The two most amazing things about him are ignorance and impudence. It is only natural that people like this should readily come under the influence of such a man.

Think of this: Thousands of these people have been living right here in Denver for years. The ministers of the gospel of Jesus are as capable here as they are anywhere in the world and the doors of their churches are always open to the belated sinner and no one is more welcome. But these lost sheep cannot think of being saved until some bombastic clown comes along and tickles them with his slang and slop and then scares them into the sheep-pen. They want something good and they get it.

That Billy is a shallow and far from up to date thinker is proved by his own words in every one of his sermons. Read what he says about the Bible: "I want to say to this audience to night before I forget it, that I believe that the Bible is the Word of God from cover to cover. Not because I can understand it, for I cannot. Not because I understand its philosophy, speculation or theory. I cannot: wouldn't attempt it, and I would be a fool if I tried. I believe it, because it is from the mouth of God, the mouth of God has spoken it."

What does he know about the mouth of God? Suppose some one should ask him: 'how did you get this so called Word of God'? The only possible answer is this: 'Somebody said so.' Well, who was it? 'We don't know; all that we can learn about it, is, that some man or men who lived long ago said so.' But you say your self that the worst liars on earth are men and that even when they try to tell the truth they are liable to be mistaken.

Perhaps the self-sufficient Billy is like millions of others who think they are Christians. They believe the Bible because they don't understand it. If you would understand that book study all things, using comparative judgment and learn the whole truth. Then perhaps the Bible will not look so important.

That the Rev. Billy is not, strictly speaking, a preacher of the letter and spirit of the gospel of Jesus, and that he is not the Christian he seems to think he is, is proved again and again by his own words. Since his conversion he has spent 27 years building up a Christian character and he defies any one to find a flaw in any of his personal habits. But he freely admits that he gets mad. He says his temper is like a sheetiron stove with too much fire in it. The two hardest verses in the Bible for him to obey are, Matthew, V, 39, 44.

39 "But I say unto you, That ye resist not evil; but whosoever shall smite thee on thy right cheek, turn to him the other also." 44 "But I say unto you, Love your enemies, bless them that curse you, do good to them that hate you, and pray for them which despitefully use you, and persecute you; 45 That ye may be the children of your Father which is in heaven; for he maketh his sun to shine on the evil and on the good, and sendeth rain on the just and on the unjust."

I believe we are safe in the assertion that more than half the people, in the church or out of it, are not able to live up to the literal sense of the doctrine above stated. And for this simple reason it seems plain that they have not the right to call themselves Christians; tho a great many of them belong to a church and openly profess to be Christians. It is only necessary to go thru the ceremony called conversion, then renounce certain sinful habits and adopt the formalism of some church. After this change they are supposed to be Christians. Yet they hold with the same tenacity to the same narrow views of life and mind, the same greed for money and property, the same ignorance and stupidity; in short, they are the same half-animal creatures having only bargained away a few of their bad habits in exchange for the promise of a soft thing in the future. And they are even encouraged by the church to hold fast to this their only hope for salvation. All this in view of the truth that the mission of Christianity, was, and still is, to humanize men.

Since Mr. Sunday has offered himself as a model Christian, I feel at liberty at least to mention the fact that I have tried to be a Christian myself; and that I am still trying. I can look back for more than 50 years and I can see myself in all those years, and I can see myself now; and as sure as I live this minute the comparison is exceedingly encouraging. I am a better man today than ever before and tho not yet a Christian it is not bcause I don't want to be one, but because I am not yet humanized. I often think that if I had none but agreeable companions I could be as good as the best if I was one of the best myself. To be one of the best it seems clear to me that we must first possess a complete knowledge of all things, then the mental discipline which depends on such knowledge. Two or more persons possessing such knowledge and culture can live on the most agreeable terms and this is heaven. I entertain the hope that some day I will be a real Christian, and I think so because I believe I know what true Christianity is and because I can plainly see that in every year of my past life I have made some progress in that direction. I have quit telling lies, I have quit stealing, I have quit swearing and I have parted company with a number of bad habits but not all. I still lose my temper once in a while when the occasion comes along. And whence this change? If my personal experience as a means to knowledge has been worth anything to me I do know from it that what I have gained in self-improvement has not come to me thru a study of the Bible or the influence of any church. I have never been converted and I have never belonged to any church, and for this I certainly have reason to be thankful. By keeping out of the church I have retained the most cherished thing I ever possessed—the right to think and act for myself. Thus free I have searched the scriptures as I would any other book and I have searched everything I could for light on the mystery of God and religion. And the more I search the more I feel convinced that His Word is not to be found exclusively in any book, nor in any class of things, but in all things. When we know all things we shall know Him.

The thing most deplorable in the work of Mr. Sunday, is his persistent denunciation of every modern innovation which is calculated to encourage the advance of human knowledge and progress. The world is going to hell by strenuous leaps and nothing can save it but dynamic evangelism of the Billy Sunday type. The church takes things too easy. They eat too much and they sleep too much and one day in the week they try to act like saints while in the next six days they are full of the old nick. Here is one of his sage remarks on the matter of education: "If I had a million dollars, I'd give $999,999 to the church and $1 to education. Not that I belittle education, but I believe that it's not intellect, but religion, that will save men."

That settles it. If we are careful about maintaining our reputation for ignorance, and if we are lucky to have a good dose of saving grace shot into us from a two-legged salvation dynamo like Billy, then sure we've got a sinch on heaven.

But who wants to be caught in a heaven like that? Surely not the man who can understand that the highest heaven is a simple result of the highest intellectual development of man; which is the consummation of mental evolution. On the subject of evolution Billy makes a few remarks which plainly show how little he knows about it. He says:

"It has never been proved. I defy you to show me where a lower form has ever been developed into a higher form. There is a development of the species. We have developed the hog, but it is still the hog. Burbank developed the potato but he has not developed it into the plum. You can develop the species, but you can't change one species into another."

This statement is offered as final and fatal to the doctrine of evolution, and sad to relate, it is accepted as true by a gaping multitude who do not know any better. It would be impossible in the small space at my disposal to recapitulate a tenth part of the overwhelming evidence in support of evolution. Perhaps I can mention a few of the most general and best known facts.

As shown by Darwin, it is possible to arrange all organic beings, vegetable, animal or man, living or extinct, into groups under groups; and which are united by complex, radiating and circuitous lines of affinities into a few or one grand class. This is known as the 'Natural System.' On the Bible theory of creation this arrangement is incomprehensible. On the theory of descent thru natural variations, selective modifications and survival of the fittest, it is exactly what we ought to expect.

As shown by Huxley, Haeckel and others, all living things past and present, are composed of one highly complex albuminoide called Protoplasm. There is some difference of opinion as to whether this substance is mechanically (chemically) organized or morphologically or divinely organized. Most naturalists, I believe, hold to the former view. In chapter 4, book 2, I have tried to make it clear that living protoplasm must always contain a mental organism—that living forms can only come from preexisting living forms. It would thus appear that all living things belong to one great class because the bodies of all are composed of the one substance. Under this largest class are a number of subclasses distinguished only by difference of form in the one substance, but presenting the widest difference among themselves. Under these again are a larger number of further subclasses among which there is less difference of form; and so on down to the species within each of which are a large number of varieties. These classes and subclasses have been named in the order from the least numerous and most widely different, down to the most numerous and least different; as follows: orders, famlies, genera, species, varieties. All this is incomprehensible under the theory of special creation while it is perfectly intelligible under the theory of descent. So it follows that all living things belong to one great class. No matter how widely different two beings may be, whether one be a saint and the other a reptile, the bodies of both are composed of the same material, differing only in form. Now, on the theory of one universal mind, which is supported by a most irrefutable array of facts, the only mental difference between a saint and a reptile, is a difference in the forms of the one mind. Since all the bodily actions of every living thing, are evident thru the movements of the one substance, prompted and guided by the different elements of the one mind, it follows that we can resolve all things into their three natural divisions; matter, motion, mind. No one can fail to see the true relationship of these three most fundamental things. Matter is the one thing which includes every other thing. Motion is the one thing in matter by which every other thing may act. Mind is the one thing in matter which enables it to be conscious as in feeling, thinking, imagination and reason. Motion and Mind, are thus the essential properties of the one Matter. These three most fundamental of things include all things and they constitute Life. They are God Himself.

It is a well established experimental fact, and Mr. Sunday admits it, that new varieties can be produced within the species in a few generations. Since the only difference between species is a simple matter of degree, what would prevent the production of a new species in a thousand or more generations?

In book 2, chapter 4, the evidence for organic evolution has been considered at some length. Here I wish to briefly notice this matter of revivalism from the view point of mental evolution. I offer what follows as a sermon to the converts of Billy Sunday and I take my text from Matthew, 7, 16.

"Ye shall know them by their fruits. Do men gather grapes of thorns, or figs of thistles?" (also 17, 18, 19 and 20.)

Which means that we can know living things by carefully observing their actions. All bodily actions come directly from the mental elements which make up the organism of the person, animal or man, and these have been classed into a number of divisions. The two first and largest divisions are the voluntary and the involuntary. Since the voluntary actions have by far the most to do in shaping the conduct of men and animals, we will consider them alone. The two subdivisions in which all voluntary actions have proper place are: (1), Impulsive or sensori-motor. (2), Deliberative or ideo-motor. The first named class of actions called impulsve. proceed directly and almost exclusively from feelings, whitch feelings are excited by physically produced sensations. For example, a sudden sound gives rise to a sensation of sound in us, and this excites a feeling of sudden fright which makes us move impulsively; hence they are also called sensori-motor. The feelings form a large department of the mental elements which include the most simple (or those hardly distinguishable from sensations) as well as the emotions and sentiments. In this department we have the most powerful exhibitions of mental force. In man it is the source of the power which makes him hysterical or drives him to insanity. The actions which follow from these elements are generally not controlled by higher mental elements, hence the conduct of the person is apt to be impulsive, foolish or violent.

The second class of actions proceed from ideas or thoughts, which occur in a more highly developed and organized mind, which mind contains the rational or intellectual elements, hence more knowledge and greater power of deliberation or judgment and control over the lower department of feelings. This class is a distinguishing mark of the rational mind, which, in its highest known perfection is found only in the human mind.

Now, remember this. These two well defined divisions of the mental elements from which all voluntary actions flow are not confined the one to animals and the other to man, but both are more or less present in all men, while the first named are almost the exclusive elements of the animal mind. The two divisions gradually shade into each other in the mind of man and so it is made up largely of the elements of the animal mind; in some more than in others. The part of the human mind which distinguishes man from the lower animals more than any other part, is the deliberative or rational faculties and the greater power of memory. There is thus a progressive gradation from the purely animal mind up thru man to the most highly developed human mind, and which is marked by the gradual addition of the human mental elements—the deliberative or ideo-motor.

Now, there is just one, and only one, way to account for this gradual change of the individual mind from animal to man, and that is what we call the Evolution of Mind and Body. As shown in book 2, a free individual mind always leads the body under the mental laws of Variation, Heredity, Selection and Survival of the forms which have gained some advantage in the struggle for existence. The conduct of the people on the average is therefore governed by both the impulsive and the deliberative classes of mental elements, while the conduct of the animals generally is ruled almost exclusively by the impulsive elements. The more a man is deficient in knowledge, judgment, self-control, the more he is apt to be subject to the animal elements and among these, either those of fear or those of courage may predominate. What the man is mentally, so he will act.

All the sentiments or passions in man, no matter how refined or gross, must be classed with the impulsive elements simply because in themselves they are not deliberative or rational.

ly intelligible under the theory of descent. So it follows that all living things belong to one great class. No matter how widely different two beings may be, whether one be a saint and the other a reptile, the bodies of both are composed of the same material, differing only in form. Now, on the theory of one universal mind, which is supported by a most irrefutable array of facts, the only mental difference between a saint and a reptile, is a difference in the forms of the one mind. Since all the bodily actions of every living thing, are evident thru the movements of the one substance, prompted and guided by the different elements of the one mind, it follows that we can resolve all things into their three natural divisions; matter, motion, mind. No one can fail to see the true relationship of these three most fundamental things. Matter is the one thing which includes every other thing. Motion is the one thing in matter by which every other thing may act. Mind is the one thing in matter which enables it to be conscious as in feeling, thinking, imagination and reason. Motion and Mind, are thus the essential properties of the one Matter. These three most fundamental of things include all things and they constitute Life. They are God Himself.

It is a well established experimental fact, and Mr. Sunday admits it, that new varieties can be produced within the species in a few generations. Since the only difference between species is a simple matter of degree, what would prevent the production of a new species in a thousand or more generations?

In book 2, chapter 4, the evidence for organic evolution has been considered at some length. Here I wish to briefly notice this matter of revivalism from the view point of mental evolution. I offer what follows as a sermon to the converts of Billy Sunday and I take my text from Matthew, 7, 16.

"Ye shall know them by their fruits. Do men gather grapes of thorns, or figs of thistles?" (also 17, 18, 19 and 20.)

Which means that we can know living things by carefully observing their actions. All bodily actions come directly from the mental elements which make up the organism of the person, animal or man, and these have been classed into a number of divisions. The two first and largest divisions are the voluntary and the involuntary. Since the voluntary actions have by far the most to do in shaping the conduct of men and animals, we will consider them alone. The two subdivisions in which all voluntary actions have proper place are: (1), Impulsive or sensorimotor. (2), Deliberative or ideo-motor. The first named class of actions called impulsve, proceed directly and almost exclusively from feelings, whitch feelings are excited by physically produced sensations. For example, a sudden sound gives rise to a sensation of sound in us, and this excites a feeling of sudden fright which makes us move impulsively; hence they are also called sensori-motor. The feelings form a large department of the mental elements which include the most simple (or those hardly distinguishable from sensations) as well as the emotions and sentiments. In this department we have the most powerful exhibitions of mental force. In man it is the source of the power which makes him hysterical or drives him to insanity. The actions which follow from these elements are generally not controlled by higher mental elements, hence the conduct of the person is apt to be impulsive, foolish or violent.

The second class of actions proceed from ideas or thoughts, which occur in a more highly developed and organized mind, which mind contains the rational or intellectual elements, hence more knowledge and greater power of deliberation or judgment and control over the lower department of feelings. This class is a distinguishing mark of the rational mind, which, in its highest known perfection is found only in the human mind.

Now, remember this. These two well defined divisions of the mental elements from which all voluntary actions flow are not confined the one to animals and the other to man, but both are more or less present in all men, while the first named are almost the exclusive elements of the animal mind. The two divisions gradually shade into each other in the mind of man and so it is made up largely of the elements of the animal mind; in some more than in others. The part of the human mind which distinguishes man from the lower animals more than any other part, is the deliberative or rational faculties and the greater power of memory. There is thus a progressive gradation from the purely animal mind up thru man to the most highly developed human mind, and which is marked by the gradual addition of the human mental elements—the deliberative or ideo-motor.

Now, there is just one, and only one, way to account for this gradual change of the individual mind from animal to man, and that is what we call the Evolution of Mind and Body. As shown in book 2, a free individual mind always leads the body under the mental laws of Variation, Heredity, Selection and Survival of the forms which have gained some advantage in the struggle for existence. The conduct of the people on the average is therefore governed by both the impulsive and the deliberative classes of mental elements, while the conduct of the animals generally is ruled almost exclusively by the impulsive elements. The more a man is deficient in knowledge, judgment, self-control, the more he is apt to be subject to the animal elements and among these, either those of fear or those of courage may predominate. What the man is mentally, so he will act.

All the sentiments or passions in man, no matter how refined or gross, must be classed with the impulsive elements simply because in themselves they are not deliberative or rational.

On this side it seems clear that we must place all feelings or emotions, as love, hate, anger, fear, sympathy, jealousy, courage, cowardice, the appetite for food or drink, parental or sexual love, the patriotic or religious sentiment, etc., etc. In this division we must place certain nervous diseases as melancholy, hysteria, insanity and the like. We meet with hysterical persons often, especially among the young of both sex, and the disorder shows itself in all degrees from ordinary impulsiveness to violent convulsions. The hysteric is one who laughs in one minute and cries in the next, who flies into a passion of anger with little or no cause, who acts in violent haste and has time to repent only in the leisure of exhaustion. This peculiarity is often found in a perfectly healthy body; in fact, it is, or may be, not a disease of the body at all, simply a disorder of the mind, which, of course must be treated by mental remedies, as education, verbal or silent suggestion, as in mental healing. It often takes the form of spasmodic patriotism or religious mania, and spreads so rapidly that nearly everybody in a populous neighborhood is affected by it. The difference between one person and another is thus simply a result of a difference in the relative proportions of the two classes of mental elements which enter into the composition of the person. If the deliberative and self-controling elements with ample knowledge, predominate, the person is in little or no danger of making a fool of himself or committing a crime. If the vicious, animal traits predominate with little or no moral education, the person is a menace to the peace of the community. If the weak, vascillating, emotional, excitable elements predominate, all of which are animal traits, the person is very liable to act the fool. All these mental elements from the human to the animal, are a direct result of the physical and social conditions under which each person lives. It is not necessary to tell my reader which part of the mind of man, the impulsive or deliberative, is most trustworthy as a guide to conduct. That part which deliberates and strives for general knowledge is pre-eminent to everything else in mind as a directer of human action. "Ye shall know them by their fruits."

Now, the observer of social phenomena need not fail to see where the converts to mobism, militarism and revivalism, are found. Every one knows the class of men and women who are always ready and often desperately anxious to take part in a case of mob violence. The greatest war in the world's history is now raging in Europe and affecting the entire world. No sane person can fail to see the fruits of militarism and the brute pugnacity of men, in this war. As soon as war is declared the streets in the cities of the belligerent countries are thronged with frenzied men, singing their national songs and howling for blood. If either side wins they gain the undying hatred of the other side and no matter what else they get they have got the worst of it and the last great war of the world is only postponed to some future time. There is one very sure and simple way to make this the last of all wars. (1) Stop fighting and disclaim all desire for indemnity or territorial possession. (2) Settle all international disputes or questions by international law. If the laws do not exist make them in the same way that any civilized country makes its laws. All national boundaries should be determined by referendum vote of the people who occupy the territory and all races of men should be separated as much as possible by state boundaries. The world should be divided into states determined by racial and religious ties and all states should be united under one international law based on the moral law. All state alliances which aim to unite two or more states against any or all the others, should be illegal. All armaments should be limited to an army and navy sufficient to protect land and sea against the unlawful element, more or less present in every social state.

But to return to revivalism. In book 2 I have tried to explain what I have called the great truth that all that is, is good, that all that happens is right, and that it is so because law is universal and all law is God's law. From which it would follow that there ought to be some good in revivalism. No doubt of it, the mode of practice employed by Mr. Sunday enables him to reach a class of people that ordinary church methods would not touch. Perhaps many of these converts will get interested in releigion for its own sake as well as in its power to keep them out of hell. Perhaps some of them will ask: 'what is religion?' whence and whither, or how is it related to this universe of things?' Perhaps some of them will privately say to themselves: 'what a fool I was to be caught in that fellow's rat trap; but I have learned something and I want to learn more. I will study religion from every possible point of view.' 'Tout bien ou rien.' When they begin to think like a philosophre there is something doing, and we can look for results. So it comes to this: The revivalist is a useful instrument in the hands of God for the good of men. And so is the devil.

It is generally admitted, I believe, that the God of the heathen is a being possessing the characteristics of an ordinary man, with the difference that he is all powerful, all wise and the maker and manager of all things. What is the difference between the God of the heathen and the God of the Bible? After a careful search of that book and all other sources of information known to me, I am compelled to admit that if there is any difference it must be in the probability that the God of the Bible or the Jews, was more civilized than the other Gods who flourished in the early days. But all the Gods of that distant age in Jewish history had the usual failings of ordinary men, which makes it highly probable that all were conceived in the brains of fallible men. They would make foolish mistakes, then repent for their folly. They would make men, then damn them into perdition for being just what they made them. When men got to fighting they would take a hand in the row and they were always on the side of the victor. We can prove all this and more by the Bible. Every one of the modern forms of faith which find justification in that book can be proved to be false by the same book. We can safely declare that of all the books in the world there is not one that contains more absurdities and self-contradictions than the Bible. It is a rule of our civil law that when a man testifies in court if he contradicts himself his testimony is ruled out. Why not treat the Bible the same way?

If we take the several parts of the Bible separately we can prove almost anything from them. The truth of the doctrine of evolution can be proved from the first book of Moses as completely as anything ever has been proved from that book. I have done this myself but I would not think of offering my work as a scientific demonstration of the truth of evolution based on fact. And let me say here that tho I have quoted approvingly many passages from the Bible, I have never once attempted to prove anything from that book. If I did I would have to do as Mr. Sunday does: declare that I believed it to be His Word, from cover to cover. This I could not do without telling an awful lie, then I would have to live in perpetual shame in the presence of the most lovable of all Beings.

According to Mr. Sunday the God of the Bible is a God of war, of love, of hatred and revenge. He says: "God hates the man who trims his sail to catch every passing breeze of notoriety." Does he mean it? If so how can he expect to escape the wrath of his God, for no man is more solicitous of notoriety than himself. But he is just what the law of life has made him and he cannot be anything else until he has been converted to a higher plane of humanity. He has the power that gets the crowds and it is a pity that he does not preach a more advanced Christianity. Some day perhaps he will be converted again but being rather stubborn and self-righteous it is not probable that further knowledge of science and philosophy will convert him. If the founder of the pure Christian gospel would appear to him as he did to the apostle Paul on the road to Damascus, (Acts, 26, 13.) no doubt he would be converted at once and like Paul he might do a great deal of good. But if this should happen he would be required to preach a more humane gospel and a more humane God; besides, he would be denounced, (as was Paul,) as an impostor or a Spiritist, by all those people who believe that modern Spiritualism is nothing but "Demonism." And at least the majority of his convertis and supporters would nct understand him. So after all it may be best for Billy to be just what he is, and so with all the revivalists.

Now, there is one way to understand the Bible; and I believe that any man who can take this view, can firmly believe and truthfully say that the Bible is the Word of God from cover to cover. But only in the sense that the Universe itself is God, that all things are parts of Him and that every man who speaks must speak the Word of God, can this statement be true. Thru all the prophets from Moses to Malachi, there is one continuous admonition to the Jewish people against sin. No one can doubt but that these solemn reproofs and instructions were spoken by some one or more intelligent and moral beings. They were not the fictitious inventions of men noted for piety. Now, if we accept the idea as to the nature and personality of God described in §53, question 4, then it follows as possible that all those communications to the prophets purporting to come from God, were actually spoken by the spirits belonging to the higher spheres of spirit life. They spoke the Word of God, just as Jesus spoke the same Word while on earth. They were first, sons of men, then sons of God by conversion, just as Jesus was while on earth. Being fallible men, they were liable to make mistakes just as Jesus did while on earth. By taking this view we are not obliged to attribute all the discrepancies of that book to the Supreme, and we are spared the absurdity of saying that we believe the book yet do not understand it.

If God is a Spirit, (Gen. 1: 2, and 2: 7,) then all men are spirits, for there is but one universal Spirit or Mind. As Jesus was a part of the Spirit of God in the flesh, (John, 8: 28, and 10: 29 to 37,) so every man is a part of the Spirit of God in the flesh. As every living thing is an association of mental elements organized and active for the purpose of maintaining agreeable relations in life, so God is an association of mental elements (humanized men in spirit life,) organized and active for the same purpose. As every living thing must occupy and manage as well as knowledge permits, a small part of this material universe, in order to keep its smaller material parts together, so God must occupy and manage the whole in order to keep its material parts together. (§53, question 8.) The material body in physical life is necessary to keep the mental elements together long enough under physical conditions to secure a permanent association and the highest degree of mental discipline thru experience as under the law of mental evolution. (book 2.) When this association is well established in this way, (tho it may not have reached the highest mental discipline,) the body of flesh is no longer necessary to life; so it may be cast off as in physical death. (book 2.)

Since the mental elements which compose the lowest and simplest forms of life cannot begin to exist alone, they cannot reproduce or duplicate themselves outside of a mental organism composed of like forms. (§4). Hence it is that every living thing must have its birth in and thru the reproductive system of a preexisting similar form of life. All forms of life above the lowest must come into existence thru a combination of the lowest; as required under the law of association which is a prime factor in the mental law of evolution. As we proceed from the lowest forms thru the scale of development to the highest in man, we see that every step higher has been gained thru some advantage in the struggle for existence, which advantage has come thru the association of the mental elements which are found to be most helpful in the life struggle. In certain lines of descent (the quadrupeds) the associations have resulted only in the development of the body; the mind having developed very little. In other lines of descent (the quadrumana) the mental development has been enormous. It is not difficult to see a reason for this great progress in intellectual development which has distinguished man from the lower animals. The exclusive use of the hind legs and feet for supporting and propelling the body, leaving the fore legs and feet to be used exclusively as arms and hands, has been possible; thus permitting the further development of both mind and body up to that of man. (book 2, also Huxley's "Man's Place In Nature," and many other works on Evolution.)

In this way the latest and highest mental elements have been created and associated together thru experience and under physical conditions as we now find them in humanized man. But the advent of the later and higher elements has been possible only on the basis of the older and lower elements. Hence it is that the body of man must at present contain all the forms of life from the lowest to the highest as the direct descendants of the ancestoral forms; and so it is that every man must have more or less of the animal in his composition.

As every man's body must contain a part of the animal kingdom, so the body of God, (the Physical Universe.) must contain the whole of the animal kingbom. As every man must keep his latest and highest mental acquisitions in one place within his body, (the head) so God must keep His latest and highest mental acquisitions (humanized spirits) in one place within the Universe. This highest place is what we call Heaven. It is the seat of the highest wisdom, the purest love to all, and the source of the power that governs all. Heaven contains innumerable societies and these are graded in a series from the lowest to the highest called spheres. (Swedenborg and others.) All that part of the Universal body outside of these highest parts is what we call Hell. Like heaven hell also contains many societies graded from the lowest to the highest. As the character of every man must depend on his ruling mental elements, these will determine his place in the Universal Mind and Body of God. There is only a little difference of degree between the lowest heaven and the highest hell. The two together exhibit a series from the lowest hell to the highest heaven and every stage in this series is a direct result of the three laws of life named in the preface.

In every living thing, there is, and must be, some degree of association, some degree of organized activity, and some agreement in the relations of its component mental elements. The end of this association and organized activity is agreeable relations; or in one word happiness. And this is life. The highest heaven is that organized assocation of mental units which secures the higest degree of happiness, and the lowest hell is that organized association of mental units which secures the least degree of happiness. But since the highest forms of life are dependent upon the lowest, there must be some happiness for all living things, else there would be no life high or low and even God would not exist.

Taking this view of the matter the way to the salvation of every man is not difficult to find. It is a simple question of intellect—knowledge and moral discipline. In other words, it is a question of that intelligent self-government, individual and social, which secures the most agreeable relations between man and man. (§59 book 2.) To know God, is to know all things and to keep the first commandment is to love all things. This is the Soul of Christianity, because it includes all the other commandments. He who loves all things, hates nothing, and to obey the golden rule, or refrain from vengeful retaliation, is always a pleasure. Knowledge of things and of life, with ordinary judgment, will enable any man to avoid all occasion for strife. The one sure way to make religion something more than a mere name for ignorance, is Knowledge and self-government.

There are many freethinkers who believe that Christianity "weakens and corrupts not only nations, but the individual, by undermining and discouraging the use of his reason." Undoubtedly the so called Christianity as now taught all over the world, weakens and perverts human reason. But not so with the true Christianity, founded on laws of Nature and which now seems to be almost totally unknown to the world.

In "Life," for October last year appears an article headed, "Figures Can't Lie," and in which occurs a statement from an English Parliamentary report on the moral status of society in England and Wales." This report has been freely circulated as damaging evidence against Christianity by the freethought people, and I have copied it below.

"Population by Religious Profession:

Roman Catholic, 1,500,000.
Church of England, 6,933,935.

Protestants, 7,234,158.
Infidels, 7,000,000.
Jews, 57,000.

Total Number of Criminals in Jail.

Roman Catholic, 37,000.
Church of England, 96,000.
Protestants, 10,000.
Infidels, 350.
Jews, 0.

Criminals to every 100,000 Population.

Roman Catholic, 2,500.
Church of England, 1,400.
Protestants, 150.
Infidels, 5.
Jews, 0

Proportion of Criminals.

Roman Catholic, 1 in 40.
Church of England, 1 in 72.
Protestants, 1 in 662.
Infidels, 1 in 20,000.

"According to this report it is 500 times better to be an infidel or belong to no church than to be a Catholic. It is 277 times better to be an infidel than to belong to the Church of England, and it is 30 times better to be an infidel than to be a Protestant."

This report, if strictly true certainly means something. But the idea that the strict adherence to the simple gospel of Jesus, (the first commandment, the golden rule and non-resentment,) is an incentive to crime, is conspicuously false on its very face. As every one knows the real incentives to crime are want, selfishness, hatred; in one word ignorance. Every mental element that makes the criminal is a result of the associations handed down from our animal ancestors and to get rid of them is not to teach the victim some outward empty ceremony which adds nothing tc his knowledge of self and the world, but to teach and encourage a constant pursuit of the whole truth about life; as an indispensable means to individual and social self-government.

The above report plainly prove the ignorance of the church. Its inability to preach and scientifically demonstrate the truth of the pure and simple spiritual gospel of Jesus and the prophets, is one of the most striking facts of church history to this day. The Bible from cover to cover is a record of ancient spiritualsm just as the "Proceding of the Society for Psychical Research," and other modern literature is a record of modern spiritualism. Both contain all the inaccuracies and fallacies of depraved man and yet in both may be found those priceless gems of truth for which every true Christian must feel it not only a duty but the highest privilege to search.

In every age of human history there are a few thinking men and women who are far in advance of the great sensual mass of people who hardly think at all. The stability of the church for ages past has depended upon this faithful plodding horde, who cannot entertain a new idea on any social question. But of late years there is a growing tendency, even in the church, to break away from the narrow sphere of Biblical revelation and early church beliefs, and to look with more respect upon the testimony of science. Geology, Anthropology, Archaeology and the like, have been steadily advancing and bringing to view a significant body of facts, in perfect harmony in themselves, but far out of harmony with the so-called revelations of the Bible. They throw a much needed and welcome light on the antiquity of man and add lustre to the life long labors of men like Darwin who studied life in all its forms for truth only.

It is not difficult to see that every man or animal's breadth of vision in the affairs of life depends on two things; knowledge and knowing how to use it. Or in one word, knowledge. Knowledge is a thing of growth, and every stage higher in its growth is marked by that change of mind which makes the subject less brutal and more humane, and which widens his sphere of vision. A faithful watch-dog will often attack a stranger passing on the street simply because there is something unusual in his mode of dress. A prisoner of war in the power of the lowest savage, is pretty sure to suffer death with extreme torture. The great war in Europe is now giving us many examples of the brutality of men who are supposed to be civilized. But what is civilization, or is there one sure test for it? It seems certain that the general atitude of society toward sin or human depravity is one searching test, if not the only one. With the lowest savage the only use for a woman is to be the slave of some man and to gratify his brute passion. When too old to work they turn her out to die without the attention of one of her nearest of kin. In the mind of such a person, love, is only a form of animal want, and hate, vengance and cruelty are the dominant traits. This, of course is not civilization. But every step higher in social evolution has brought something to the eradication of sin and the betterment of the life of women. And what is the situation to day? There is no reason to think that the women and children of France and Belgium, had anything to do with the cause of this war. Yet if reports are true the German soldiers who invaded these countries have put on record facts which prove that as a nation Germany is not yet civilized. Yet the unceasing boast of Germany is of her incomparable civilization and culture. Every nation is responsible for the acts of its soldiers. If the discipline of the army has little or no moralizing influence upon the soldier, what can we expect of the civilian population of that country?

But Germany is not the only uncivilized nation on this planet. Every informed person must know that more than half of the people in every part of the world are afflicted with that besetting sin of avarice, which is a simple result of the necessary conditions of planetary life. Still it must be admitted that Germany, in the late war, has given us a notable example of that almost universal belief that this world must be ruled by a so called superior class of people. The Kaiser really believes that "the German people are my people and if my brave soldiers can conquer this world it is mine by divine right." The Jews long ago when succesful in plundering and murdering the people of neighboring tribes, believed the same, so says the Bible, and history records many examples of the same belief. If there is one form of selfishness more beastly than all the others it must be that which claims divine sanction. Nevertheless this claim was made to justify the slavery of the black man here in the United States 60 years ago and it is even now made to justify the industrial slavery still in practise all over the world.

The majority of the people, even in the most democratic states, either believe in or unknowingly give their support to that industrialism which divides the social body into two classes, the one class owning and enslaving the other. And they would base this distinction on personal worth; either a gift from God or a mark of superiority. And what have they got to prove it? Nothing worth a tinker's notice. Nothing in character or moral worth; nothing in genius or intellectual ability; nothing but that covetousness or business ability which brings great wealth. "I am a superior being because I have got the money. My millions are my own because I made them in legitimate business, and this is the proof of my superiority among men. My son is my offspring and my legitimate heir, and he must bear my mark of superiority even if he is an idiot." This is the best excuse, the only excuse, that these people ever have or ever can, offer for their right to rule the world. Call it constitutional industrialism or any nice name, it is animal selfishness just the same.

Industrialism has not yet learned that it has a legitimate and limited sphere, determined by humane and Christian laws, and that it has long out-lived its usefulness and overreached its natural boundaries. Among the average of men there is perhaps not one in a hundred that would not be a millionaire if he could and he would think it perfectly right. Even if it could be made clear to his mind that there is a simple form of government under which poverty with all its ills is impossible, and under which every man can have for himself the fruits of his industry just so far as measured by his personal worth to society and no further, it is doubtful whether he would assent because he might loose the chance of getting rich; and if so he is not a Christian.

The fact that the now well established doctrine of evolution is still disputed or held in doubt by so many intelligent people, or at least that it does not apply to religion, is strangely out of place in this age of progress. And of course a leading reason for this drawback is the preaching of that emotional stuff by men of the Billy Sunday stripe, who continually exhort the people to hold fast to the old forms of faith. They tell us that the missing link between man and the lower animals has never been found, and no doubt they are right because finding a thing always depends on the way we look for it. The truth is, this socalled missing link has never been lost to the eyes of those who can see straight. Anatomically it has been clearly made out, but more clearly it proves on examination to be a simple case of mental development in which the mind of the present man has slowly emerged from his animal ancestors in exact accord with God's plan of creation. (Chapter 4, book 2.)

To all who can accept this doctrine of evolution as here applied to religion, the question will naturally occur. What is the next step in the progress of religion? For Christendom at least, it seems plain that the next move must be that which will unite all the people under a true Christian brotherhood. This of course means not only the union of all the churches, but the union of church and state. To unite all the churches on a basis of agreeable relations it seems that most of the churches must get rid of a lot of useless ceremony, and hold only to the one principle of Christianity—the First commandment. (Matt. xxii, 37.)

Of this commandmeht the Master said.—"This is the first and great commandment. And the second is like unto it, Thou shalt love thy neighbor as thyself. On these two commandments hang all the law and the prophets."

This commandment is of course the ground of all the Christian precepts—the golden rule, non-resistence as applied to human beings, and justice to all. If God is not all things, at least all things belong to Him, and if life holds anything good for us we are under solemn obligation to Him for that good. To love Him is to love all things and this of course is possible only when we know all things. There is a true Christian Philosophy, now, and always before us, appealing constantly to the most ordinary intelligence, and it plainly points the way that all the people of this world may be united in one great social body, as one with God; even as was Jesus Christ the first of Christians.

The union of church and state is necessary in order to secure the power to enforce the moral law. The constitution of the state is also that of the church because both rest upon the same principle of social relations. Church laws, civil laws, and the laws of God are all one. Any violation of the law or disturbance of the peace is disloyalty, and punishable accordingly.

CHAPTER NINTH.

WHAT IS DEMOCRACY?

Before we try to answer this question it seems best first, to try to answer at least two deeper questions, namely, what is 'justice,' and what is 'liberty?'

Men are distinguished from the lower animals, not alone by difference in bodily shape, but significantly by a higher development in man of certain mental traits, notable among which are the moral sense, sense of justice and liberality. The higher animals show these traits to some extent but they have reached the highest development in man. The great majority of the people now on earth and who claim to be civilized, have an innate sense of justice which they aim to exercise in their business and social relations. When a number of women and men are eating and drinking together they do not act like hogs. But not so in their industrial pursuits and in all those activities which aim for the things which are supposed to bring success in life.

In the individual, to the extent that justice is lacking, to that extent we are apt to find instead unjust ambition, avarice, or undo regard to one's own interests, ends or advantage. This is Individualism as opposed to Socialism. Injustice as opposed to Justice. But what is Justice?

If we say that a just act is one that involves the least possible amount of discomfort or pain to others of the same class, we have then answered both of these questions—what is justice, and what is liberty? A just act can aim for nothing better than the happiness of others of the same class, and no being of the human class can justly claim the liberty of doing an injustice. What an unjust act is in any case can only be determined by the highest wisdom of the class or community. In a community of human beings right and just conduct, either in the individual or the society, is that which promotes the happiness and mitigates the ills of others in the community. In a community or class of animals, right conduct is that which secures the greatest good for the individual. 'Might makes right,' is a necessary law of animal life, but with humanized man it is out of place. The liberty of the animals is not limited by the moral law because they cannot understand it, but with a man, if humanized far enough to have a clear sense of justice, there is a well defined moral limit to his liberty, as above described.

That there is an ideal form of government or a principle of social relations under which all the people may live in peace and harmony, and which has been believed in as possible for thousands of years, and all this time slowly taking definite shape in the human mind, is not doubtful to the many who have looked the matter up. Democracy was named by the Greeks who combined the two words of their language meaning 'people' and 'power'. Aristotle recognised three possible forms of government; the Monarchy, the Oligarchy, and the Democracy. Under the first named form the people are ruled by one man. Under the second the people are ruled by a privileged class of men who gain their power to rule thru force of arms, heredity, assumed divine right, or great wealth. In the third the people collectively may govern themselves. The Monarch is something like the King, Emperor, or Czar of more modern times. A monarch or king may be an absolute despot with absolute power, or his power may be limited more or less by civil law and by a legislative body of wise men, like that of Italy, or England, or the United States. The oligarchy or government by a privileged class may be as despotic as the absolute monarch, or its power may be limited as in the case of the monarch. In the democracy the aim is, and always has been, more liberty for all the people.

The history of democracy is an interesting part of human history. Like religion, like civil law, like the sense of justice in man, in one sentence, like the human intellect, this ideal of happy social relations has been slowly passing thru the necessary course of mental evolution. Government must have commenced to exist with the beginning of society, since society would have been impossible without some form of government. In fact, as we shall see later, the constituent principle of all government is individual self-control. Any social state must have some degree of organization, and so may be regarded as an individual having some degree of self government. So with all living things down to the most simple. All must govern self in order to live.

In the family we find the first binding element in the social state. The love of parents for each other and for their children, begins far down in the animal scale, almost with the beginning of planetary life. The struggle for existence was at first almost exclusively individualistic being socialistic only so far as actuated by family ties and by the need of help and protection within the family circle. The family thus becomes an individual of the first and lowest social order, and the tie that binds is the paternal love which guides and protects the members of this group. It must be a shallow observer who could fail to see what is necessary to constitute a well ordered and happy family. First, a wise administration emanating from the father or family head, and incited by the love which knows no partiality or injustice. Here, in the exact meaning of the word we have a form of governmen. Wise men of the present day have told us that the true function of all government, is, to restrain the evily disposed, to protect the weaker and well disposed, to help the people in their common pursuits and to improve social conditions. These undoubtedly are the necessary attributes of any government worthy of the name and that they apply to the family as well as to any state will not be disputed. Children must be cared for under well known rules of restraint, protection, encouragement and education, and so with men. The criminal element is more or less present in every social state.

Here is something that deserves particular attention. The well ordered and wisely governed family affords an example of the one and only true principle of government; an example so complete, so perfect, so entirely without fault, that it would be impossible to find in human history another example to compare with it. The first essential in this modal form of goveranment is paternal or fatherly love. No monarch or king, no president or ruling class, has ever felt the love for his people that a wise and good father may feel for his family. They are his own and nearer to his heart than any other thing. This is the corner stone in the perfect family edifice and of course there is no comparison of this with others unless it be a Christian community of like families held together by the same tie of love. To realize this it would be only necessary to know that all life is one with God and to keep the first commandment. In the family the first commandment would read thus. "Thou shalt love thy Father and Mother with all thy heart, mind and strength. Thou shalt love thy Sisters and Brothers as thyself. In the Christian community of like families the same principle of social relations applies in the same way, and with it all the necessary rules and obligations of a government as above described.

The family being thus regarded as an individual of the first and lowest social order, the community of like famlies would be regarded as an individual of the second and next highest social order. Here we have a model state built after the same pattern as that of the model family. Its first principle is the first commandment and the rules of civil justice and service which rest thereon, and which, by all the criterions of right must make of it a perfect form of government. And what is this but a system of pure Democracy? and would not the word 'Christianity' answer for a name just as well?

Of course a community of families like this might be called a tribe, but it is a class of people held together and distingushed by well known laws of social unity, and this is all that can be implied in the words 'state, commonwealth or the government.' The avowed object in all the existing states or forms of government is to unite the people and keep them together. Two ways of uniting the people and holding them together have been in practice since the beginning of human history. First and oldest, is that of a monarch or a ruling class, who exercise an arbitrary power under which the people are compelled to obey whether they like it or not. Second, that of a pure democracy, under which the people are united and held together as they would be under the first commandment and its civil obligations.

The first named is that practised by men in governing the animals and it is justified by the brute law of might.

On the Christian precept that all men are equal before God, and on the Democratic principle that all men are equal before the civil law, it is not justified by the same brute law of might. But there is a higher law under which might is always right, and this is the human law of might. In the family this law is indispensable in the right management and bringing up of children, and in the democratic state it is equally necessary in the control and discipline of the criminal element.

From this evolutionary point of view we are beginning to see what democracy really is; and that it is a first principle of life, which shows itself at the very beginning of life on this planet, and that it has played a necessary part in every life struggle for existence from the beginning to the present day, may be readily seen if we only take a philosophic view of the whole. First, the mental organism; without which there is no life. The lowest and most simple of these organisms is, and must be, an association of mental elements first among which are those of nutrition and reproduction. These elements cannot exist alone, nor can they exist together without agreeable relations to some extent, among themselves and between the organism and the external world. This most simple mental organism must be a self-governing living individual, with some power to control the movements of its own body in order to live. This power is directed by the conscious mind of the individual in the activities of life, and the efficiency of its control of self will depend on its mental development under the law of evolution.

Here, in the lowest forms of life, we find a perfect example of individual self-government; and what is this if it is not democracy pure and simple? Mark the word 'individual' in this connection. Self-government is not the government of one individual by another individual, but a government wholly contained in one individual—the self-governing self. If democracy is self-government, always aiming for agreeable relations within self and between self and the external world, then of course we have in the most simple thing that lives on this planet a perfect example of the true democracy; lacking only in that higher development which must necessarily depend on higher mental development. Mark these words; 'agreeable relations within self and between self and the external world.' No doubt there are many cases of disagreement, especially among the animals and uncivilized people, and which have been caused by pre-established associations coming down thru different lines of descent. Two individuals of different lines of descent cannot agree because they have inherited different tastes, habits, bodily shapes, and antagonistic sentiments, and like cats and dogs they quarrel because they do not know any better. Such cases are conspicuous among men and they have a similar bearing on the evolution of humanity. There is a wide difference between the man-like apes and man and we could not expect to be able to unite the two on terms of equality before the law, and under agreeable relations. And why? Simply because the ape is too much of a brute. The different races of men are now so near alike that it must be admitted that if any of them are on the highroad to humanity, all must be, and they are growing more and more alike in every passing century. Migration, progress in learning means of communication and transportation, the diffusion of knowledge, the mingling of races, in short, human evolution on the only lines that seem possible, (and they also seem entirely sufficient) under planetary conditions, are helping to bring all men into that bond of unity which is the only security for peace on earth.

Without further comment it may be safely assumed that all the different races and nationalities of mankind are now near enough alike to be brought under one world-wide form of government. But what form of government would be most efficient for this purpose? There is really but two possible forms to chose from; (1), Autocracy; in which all the people are governed by one man or a privileged class of men. (2), Democracy in which all the people govern themselves, acting thru representatives, chosen by ballot. It must be either a government of all the people by a part of the people, or a government of all the people by all the people. Any part cannot be equal to the whole.

Another distinction in government is: According to the theory of the form and mode of operation of the mental organism, (Chap. ii, book 2,) all forms of government must be the same in mode of administration. Society is, and must be, a mental organism governed by the same laws that governed the individual mental organism. In autocracy, the administrative center is under the control of one man or a privileged class of men. In democracy, this center or social sensorium is under the control of all the people. In the individual, the sensorium of course is under the direct control of the dominant reason, judgmen, sentiments or feelings of the individual man or animal.

Whatever be the governing traits or mental composition of the monarch, the autocratic ruling class, or the democratic majority of all the people, that will be the determining factor for peace and harmony in the community or state. Animal inefficiency in self-control means mis-government hence ther is trouble, and so with the man. There is hardly anything more simple than right and wrong self-government and that its efficiency for the right will depend on knowledge and practical education, is equally simple and conspicuous. As the animal must be the master of his own body in order to make the best use of it, so the man must own and operate his own body in order to make the best use of it. The efficiency of the body as an instrument in the pursuits of life will depend on the perfection of every part and this again on the right care and mannagement of every part.

Right here we are face to face with one of the vital principles of pure dmocracy. Just as it is to the best interests of the individual, man or animal, to take the best possible care of every part of the body, so it is to the best interests of the state or nation to take the best possible care of every part of the social body. Exactly the same administrative principle would apply to any association of states or nations, even so far as to include the entire world under agreeable relations, and this would be a world democracy.

For more than a thousand years democracy in some form has been the ideal dream of many far seeing men, and no doubt the reason for this is that ever present class struggle between the oppressed and the oppressor. On the one side the people want more liberty in the common pursuits of life and happiness and on the other side the ruling classes want more power to go on with their plans for conquest or self aggrandizing ambitions. To gain this power it is necessary to control and discipline the people and to this end it is necessary to own the people. The ownership of the people is a simple matter of class ownership of all public property. When that which all men need and must have in order to live, is owned and controled by a part of the people, that part will own and to some extent control the rest of the people. When that which all men need and must have in order to live, is owned and controled by all the people, each possessing, using and enjoying, according to the value of his public service, then every man will own himself so far as he is able and willing to fulfill his public obligations; and there is no ownership of public utilities and people, and hence no power wielded by a ruling class to carry out some scheme of self-emulation.

It thus comes about that in all ages of human history an aggressive dominant class who want to rule the world or as much of it as they can get control of, exists; and it is the antagonism and strfe between this class and the under class which has kept the world in an almost continuous state of war; hence the dream of democracy as an antidote.

The animals often revolt against deprivation and suffering, and of course we must expect the same of men who believe that they are better than cattle. If we keep a pig in the same pen for a long time the pig may get so used to the situation that he will refuse to leave the pen when given his liberty. It has been said that many of the colored people in the southern states, refused to leave their masters when freed from slavery, and there is reason to believe that they had been well treated and did not want to break agreeable relations even in slavery. Abuse a dog and he is liable to bite you, but treat him well and he will love you. From the animal to the human there is a gradual process of mental development in which the individual gradually becomes more humanized and more of a democrat. To some extent a dog is a democrat because he loves his master when well treated and hates him or fears him when mistreated, and the master is not a democrat if he mistreats even a dog. But there is a wide difference between dog democracy and human democracy, and the difference is simply that of a difference in intellectual development. The dog cannot know what slavery or mental inferiority is, but the dog can and does know very well what kind treatment is. No doubt many of the colored people do not fully realize what slavery is, but certainly not very may of them are totally deficient in the sense of justice and they can feel unkind treatment and respond with resentment quicker than any dog.

How many of the colored people of the United States today would willingly go back to slavery? Is there a public man today who would dare to advocate slavery? Compare the present time with the time just before the civil war 60 years ago. At that time perhaps more than half of the people of the United States really believed that negroes were not a legitimate part of the people, that they had no constitutional rights and that they are not mentioned in the Declaration of Independence. The Supreme Court of the United States sutained this opinion. A decision by this Court published in 1857, was to the effect that a "slave or the descendent of a slave could not be a citizen of the United States or have any standing in the Federal Courts."

Abraham Lincoln the one man of that time best qualified to combat this decision did so with a power and skill that has made him the greatest of the champions of freedom and true democracy. His animating denunciations of slavery, so well calculated to make the people think, are now classed among the masterpieces of the age. They are found in his public speeches and debates with Stephen A. Douglas. Douglas was a democrat, or as much so as he knew how to be and we can take him as a fair example of the democracy of that time and even to some extent of the present time. He was the author of the Kansas-Nebraska bill, passed by congress in 1854, and which gave to these Territories the right to decide by ballot whether they would be free states or slave states. The early manhood of Lincoln was that of the common laborer and here no doubt is where he got the education which enabled him to understand so well a most important truth about the labor situation all over the world and in all historic times as well as at present. I quote his words.—

"Equality in society alike beats inequality, whether the latter be of the British aristocratic sort or of the domestic slavery sort. We know Southern men declare that their slaves are better off than hired laborers among us. How little they know whereof they speak! There is no permanent class of laborers among us. Twenty-five years ago I was a hired laborer. The hired laborer of yesterday labors on his own account today and will hire others to labor for him tomorrow. Advancement, improvement in conditions, is the order of things in a society of equals."

Who are the 'British aristocratic sort' and the 'domestic slavery sort' if they are not the autocratic ruling class and the democratic working class, more or less present today in every civilized country on earth? Lincoln continues.—

"As labor is the common burden of our race, so the effort of some to shift their share of the burdon onto the shoulders of others is the great durable curse of the race. Originally a curse for transgression upon the whole race, when as by slavery, it is concentrated on a part only, it becomes the double refined curse of God upon his creatures. Free labor has the inspiration of hope; pure slavery has no hope. The power of hope upon human exertion is wonderful. The slave-master himself, has a conception of it, and hence the system of tasks among slaves. The slave whom you cannot drive with the lash to break 75 pounds of hemp in a day, if you will task him to break a hundred, and promise him pay for all he does over, he will break you a 150. You have substituted hope for the rod. And yet perhaps it does not occur to you that to the extent of your gain in the case, you have given up the slave system and adopted the free system of labor." ("Little Masterpieces" Douleday & McClure Co, N. Y.)

Bliss Perry the editor of 'Little Masterpieces' says of the above passages which I have quoted from Lincoln on slavory.

"From early manhood Lincoln's sympathies had been strongly enlisted on behalf of the slaves. The contrast between slave labor and free labor has never been stated more tersely and vividly than here."

True, and this is only a small part of the many vivid and convincing utterances of this man whom we can justly call the greatest of modern democrats. Every loyal American should read his speeches in particular the one at Springfield Ill. June 16, 1858, and the one at the Cooper Institute N. Y. Feb. 25 1860.

" A house divided against itself cannot stand. I believe this government cannot endure permanantly half slave and half free.

I do not expect the Union to be dissolved—I do not expect the house to fall—but I do expect it will cease to be divided."

It is said that the best friends of Lincoln objected to the statemen that 'this government cannot endure permanently half slave and half free.' And it was the opinion of many that his defeat for the United States Senate by Douglas was caused by such sentiments. But it is now admitted that his repeated and forceful denunciations of the social conditions of that time did more to bring his views before the whole country and to shape his future political career than anything he ever said. In 1860 he was chosen as the Republican candidate for the Presidency; and was ellcted. The next year the war that put an end to that most inhuman form of slavery which degrades humanity to the level of the beasts, was declare.

Sixty years have brought great changes in the public mind in the lines of social evolution. Looking back over the history of humanity we can see the most unmistakable evidence of the continued presence of a class division in the social body broadly called the autocratic and the democratic. The fear of poverty, the spirit of industry, the disposition of the many to shift their part of the common burden of labor onto the shoulders of others, rightly stigmatized by Lincoln as the curse of humanity, and above all, that aspiration for power to rule or ruin others and so build up dynastic states governed by an ignorant selfish class, is of course responsible for this social rupture which is the direct cause of all social disunion.

The revolutions in England (1642 and 1688) gained for the people parlimentary rule. The revolutionary war in America, (1776) gave independence to the United States. The French revolution of 1780 gave a republic to France. The civil war in the United States, (1861) gave freedom to millions of slaves. The revolution in Russia (1917) and a similar movement in Germany in the present year (1918), along with the great war in Europe of the same period, have swept from this planet the two or three worst forms of autocratic rule now existing. The forward steps in democracy or social evolution are so plainly marked in human history that it seems that no ordinary person can read without being impressed. Efforts to unite the people on terms of agreement have been made not only in families, tribes, states or nations, but even in a league of all nations. The ties that bind in the family are (1). sexual and parental love, (2) the desire to restrain, protect and properly care for the members of the family group. The ties that bind in the tribe or state are those of the ordinary functions of all governments, more or less developed according to the intellectual development of the social body. (p. 308. The ties that should bind in a league of nations are exactly the same as those that hold the people together in all the lower states, tribes or families, and which holds together the mental elements in all the individuals from the lowest up to man. It is a simple case of that association of the mental elements in the individual, or the individuals in the family, tribe, state, nation or league of nations in a world democracy, which secures the most agreeable relations. It is the way to the Kingdom of God on Earth—the prayer of humanity.

"Thy kingdom come. Thy will be done in earth as it is in heaven." (Matt. VI, 10.)

In view of the evolution of democracy one of the most interesting parts of human history is that which describes the many attempts to establish a league of nations for the purpose of maintaining peace on earth. Heretofore a number of statesmen, rulers and thinkers, have proposed plans for averting war the principal among which may be briefly noticed here.

In 1620, Henry of Navarre, (Henry IV of France,) proposed the plan of a 'Christian Republic,' containing the fifteen states of Europe. This plan was to employ force directed by a common council, and making war against all unchristian peoples, in particular the infidel Turks. Disputes between the member states were to be settled by the interstate council. For some reason not mentioned this plan did not come to a realization; perhaps because the pure democracy of christianity was not in it. The christian gospel forbids the killing of infidels simply because they cannot be converted. The one fact more than any other, which has interfered with the spread of christianity, is the absence in the people of the spirit of pure democracy.

In 1693, in "An Essay Towards the Present and Future Peace of Europe." William Penn proposed the plan of a 'great diet,' composed of the monarchs of Europe in which all disputes were to be settled. But this plan plainly interfered with the ambitions of monarchs to extend their dominion over smaller states, as did Prussia in later years. At that time Louis XIV of France aspired to a position of supremacy over all Europe just as Germany did prior to 1918. International rivalry and jealousy to the fighting point kept Europe in a state of ferment and no such agreement was possible.

In 1713 Abbe Castel de St. Pierre published his book containing "A Plan for Perpetual Peace." Like the others this was a failure because it required a binding obligation to keep the peace thus relinquishing all aspirations for the thing which constitute a source of great achievement in war. Rousseau then made some amendments in the plans of the Abbe but still to no effect. The ruling classes of Europe were not yet civilized far enough to be able to control their innate greed.

About the time of the French revolution Jeremy Bentham of England took up the matter of lasting peace. His idea was that morality instead of force should be employed in the administration of state affairs. But it seems to have not occurred to this statesman that a court with no power to enforce its decrees but that of moral suasion, would be certain of failure even in the present state of society; much more so at that time. Morality without the force of an ordinary appeal would not be morality at all, and without some compelling force it would be of no avail even in the highest state of society now on earth.

In 1795 Emanuel Kant the Prussian philosopher proposed a plan for a durable peace which was based upon the idea of a "Super State,"—a powerful state or association of states, able by force of arms to rule and regulate the affairs of all the other states, and the super state was to be Prussia of course. This idea was very popular in Germany just before the great war of 1915-1918. Like all the others, this plan, tho a necessary principle in the evolution of animal life on this plane, must eventually go to the scrap heap of all the ideas which have outlived their usefulness. In a society of equal individuals under a pure democracy there is no super individual. In a society of states or nations under pure democracy there is no super state.

Next comes Hegel another Prussian philosopher with a plan similar to that of Kant but going much deeper into the matter of training the under class on lines which make for efficiency in the business of war for conquest.

In 1815 the "Holy Alliance" was organized by the kings of Prussia, Russia, Austria and France. The object was to use the combined force of arms of these countries in putting down revolutions anywhere in Europe. This was evidently a combine of the ruilng classes of these countries for the subjugation of the under classes, and tho a strange misuse of the word 'holy' due no doubt to ignorance of the true meaning of the Christian gospel, the plan was successfully put in use in Spain in 1820, when the French army put down a revolution and restored the Bourbons to power. England having made some progress toward democracy, perhaps thru her experience with George Washington in America, had declined to join the holy alliance. In his message to Congress in 1823 President James Monroe, with the advise and promised support of England, promulgated what has been known as the Monroe doctrine. This declaration means that the United States will oppose the attempt of any power, European or Asiatic, to interfere with any of the American colonies or governments. Spain had shortly before lost by revolution her South American colonies. France had lost Haiti and Portugal had lost Brazil. The story of these revolutions is much like that of the American revolution which gave independence to the United States. The mother countries misused power because of ignorance and selfishness, hence democracy gets a hunch.

From this on to the present day the powers of Europe and America, acting exactly like competing business men within the state, ever seeking for advantages in commercial expansion and in all possible ways conducive to self-interest, have passed the time. The place of England on the map with reference to the American continent, naturally gave her an over-sea commercial advantage over all the other powers of Europe. England therefore persisted in refusing to join the holy alliance, and its final disintegration was the inevitable result. And so it was that the only league of nations in history that ever amounted to anything proved to be a failure because it was opposed by England and the Monroe doctrine in America.

The future historian will not fail to notice the real bone of contention and seat of discord among the nations of earth, which has made impossible any heretofore proposed form of alliance. Every attempt to establish a permanent league or society of all the nations, has heretofore failed, simply because the parties or nations concerned, could not relinquish the ambition for a balance of power which might enable some one or some group of them to gain supremacy over the others, thus dividing the whole into at least two opposing classes, and so insuring the impossibility of agreeable relations. "A house divided against itself cannot stand." In a pure democracy class divisions are impossible. In a society of individuals which makes agreeable relations secure, all must be equal before God and civil law. In a society of nations exactly the same principle applies. A permanent society of autocratic nations united on the principle of pure democracy might secure agreement among the nations or ruling classes of the nations, but it would not secure agreement among the individuals within the nations. But by applying the principle of democracy both between the individuals within the states and between the states within the society of nations, as in a World Democracy, then certainly there should be perfect agreement thruout the whole.

At the present time (Feb. 1919) the leading statesman of the United States, England, France, Italy and Japan, are assembled at Versailles in France to discuss the matter of establishing a league of nations for the prevention of future wars. The greatest war so far in history and just now ended, has again brought the people to a striking realization of the need of an international covenant which will make impossible the recurrence of another such calamity. The world is now growing more democratic, at a pace more rapid, than ever before, and the horrors of this war are doing the work. It seems clear that a deluge of blood and destruction was the one thing necessary to arouse the people to a sense of the deplorable social conditions of the world and certainly the hand of God was in it. The subtile secret diplomacy of the past is almost totally absent in the present conference. It seems to be fully understood that a future permanent league must be different from all others heretofore proposed. What the form of this league is to be is not yet disclosed, but late reports say that President Wilson will soon start for America and that he will bring with him a draft of the coming league of nations. That the new league will be a much nearer approach to a pure democracy, much less mixed with autocracy, seems very evident since our President and his associates are having a great deal to do in framing it. In the President's address to Congress Jan. 8. 1918, he has outlined the aims of the U. S. in this war, also the form of league or covenant which he thinks will insure a lasting peace for the world. I quote his words.

"We entered this war because violations of right had occurred which touched us to the quick and made the life of our own people impossible unless they were corrected and the world secured once for all against their recurrence. What we demand in this war, therefore, is nothing for ourselves. It is that the world be made fit and safe to live in; and particularly that it be made safe for every peace-loving nation which, like our own, wishes to live its own life, determine its own institutions, be assured of justice and fair dealings by the other peoples of the world as against force and selfish aggression."

The above statements cannot be misunderstood. We entered this war not only in self-defense but in the defense of that well known principle of justice, which defense we owe to all mankind. The attitude of Germany, Austria, Bulgaria and Turkey, toward the rest of the world now more democratically advanced, was plainly that of the old barbaric spirit of autocracy, which has always divided the societies of the world, not only those of states or nations, but those of the people within states or nations, into two warring factions, the one ever striving unscrupulously to promote its own private ends at the expense of the other, and the other always clamouring against the powers that rule. Whether it be between the states of the world or the people of the states, it is the same thing, and it is the one thing which always has and always must make peaceful relations impossible. Among the nations it is the disposition of the large and more powerful nations to overpower and enslave the smaller and weaker nations. Among the people in the nations it is the disposition of the large and more powerful business interests, individuals or corporations, to overpower and enslave the smaller and weaker business interests; the business of each individual or corporation being the pursuit of the things necessary or useful in life. Among the animals it is the same. The large and more powerful animals always take what they want without regard for the feelings of the smaller and weaker animals.

That this social rupture and contention exists all over the world, and that it is the same hideous thing not only among the nations of the earth, but among the people and the animals of the earth, and that it is the direct source of all the avoidable troubles of life, and that it is an efficient instrument in the hands of God to teach the world how to avoid trouble, is not only demonstrated by a logical view of the facts of all history, but it is convincingly set forth in President Wilson's program of world peace. I quote from his address to Congress Jan. 8, 1918.

"All the people of the world are in effect partners in this interest, and for our own part we see very clearly that unless justice be done to others it will not be done to us. The program of the world's peace, therefore, is our program, and that program, the only possible program, as we see it, is this:

"First—Open covenents of peace, openly arived at, after which there shall be no private international understandings of any kind, but diplomacy shall proceed always frankly and in the public view.

"Second—Absolute freedom of navigation upon the seas, outside territorial waters, alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.

"Third—The removal so far as possible of all economic barriers and the establishment of an equality of trade conditions among all the nations consenting to the peace and associating themselves for its maintanance.

"Fourth—Adequate guranantees given and taken that national armaments will be reduced to the lowest point consistent with domestic safety.

"Fifth—A free, open and absolutely impartial adjustment of all colonial claims, based upon a strict observance of the principle that in determining all such questions of sovereignty the interests of the populations concerned must have equal weight with the equitable claims of the government whose title is to be determined."

The above quoted passages are the first five of Mr. Wilson's Fourteen points on the matter of world peace, and so far as they go the spirit of pure democracy is plainly in them. The next following eight points are occupied with the settlement of all questions affecting Russia, Belgium, France, Italy, Turkey, Poland, Austria-Hungary and the Balkan states; and the plan of settlement is set forth in the above five points. Point fourteen concerns the formation of a league of nations and is as follows.

"Fourteenth—A general association of nations must be formed under specific covenants for the purpose of affording mutual guarantees of political independence and teritorial integrity to great and small states alike.

In the matter of the settlement of all questions affecting the interests of the nations involved in this war and above named, the five points of Wilsonism are very clear. The immediate evacuation of all invaded territory and suitable restitution is demanded of Germany and her allies. A sincere welcome to all into a society of free nations, under institutions of their own choosing, must be assured. Everything possible must be done to secure the freest co-operation of these nations among themselves and with all other nations, for the independent determination and development of their own political or national policy.

Here is a noteworthy fact. Every point in Mr. Wilson's program of peace applies to the individuals within the nations, in exactly the same way that it applies to the nations. A nation is a corporate body of people and under any form of government it must be an individual—an association of mental elements organized and active in the affairs of life, for the purpose of getting what they want. In the ordinary business affairs of the nations the principle of justice must be an imperative rule of conduct in order to maintain peaceful relations. In the usual business affairs of the people of any nation, the same principle of justice and square dealing must be an imperative rule of conduct in order to maintain peaceful relations. It is only necessary to make perfectly clear the rules of conduct in the nations and in the people, toward one another, in order to secure the agreeable relations necessary to peace, The same law of justice with its necessary rules of conduct, would apply to the animals, if they could understand it; and we might say the same of the majority of the people in every community. The situation today in all the highest places of civilization is that of the same old and ever present industrial strife between the same contending parties, now even more intensified than before, as a result of the greatest war of nations in history. We hear from every part of the globe the continued outcry against high prices for all the necessities of life, and that this is largely due to profiteering is proved by Board of Trade figures and by the fact that vast fortunes have deen made since the war began. Secret business diplomacy is being worked to the utmost and governments are employing agencies for heading off the crafty profiteer.

The full text of the constitution of the league of nations as formulated at the Paris convention was published on the 15th of Feb, 1919. It is the longest step toward a complete world democracy yet made in world history. The power behind it is that of the United States, the British empire, France, Italy and Japan, with four other states to be selected later. This is the military power that crushed Germany and her allies and no doubt it can rule the world if backed by the moral principles of matured democracy. But in the present social state of the world it can be applied only to the nations and if rightly and rigorously carried out it must prevent wars in future. According to Lord Robert Cecil, head of the British league commission, "the results accomplished embrace two main principles: First, no nation shall go to war until every other means of settlement shall be fully and fairly tried: Second, no nation shall forcibly seek to disturb a territory's integrity or interfere with the political independence of the nations of the world."

Mr. Wilson says of this constitution: "There is one especially notable feature in this document. We are done with anexations of helpless peoples, at times accomplished in the past for the purpose of exploiting these peoples. And so while this is a practical document, it is above all a humane document. It is practical and at the same time it is designed to purify, to rectify, to elevate."

One conspicuous fact about this league is this. It was called forth by an urgent demand from all the people, and it has been framed to meet that demand The ruling classes of Europe were divided as they always have been. On the one side the selfish spirit of autocracy ruled, and on the other a more advanced democracy; the one fighting a battle of conquest and the other a battle of self-defence. The people are crying for peace and this league offers a means to that end. World history affords no example of permanent peace under autocratic rule, and the reason is not hard to find. Autocracy always divides the people into two classes, the upper and the under class. Autocracy has been tried in every possible form and in every case it has proved a failure. Pure democracy has never been tried in a single case, and why? The world does not know what it really is. But it is an universally admitted fact that the people, especially those of the under classes, have made greater progress under the most advanced forms of democracy, than they have under the older forms of autocracy. For example, compare the social states of the British empire, the United States and France, with those of Germany, Austria-Hungary and Russia. Since the triumph of democracy in this war has made the world safe for its future development, and since autocracy has made such a miserable failure as a means to peace, is it not natural for rational being to look to democracy for the final solution of this problem. If the direct cause of all wars is due to the division of society into disagreeing classes, and this it certainly is, and if all disagreements on social questions are a direct result of ignorance of the fundamental principle of social unity, and this is also true, then, is it not reasonable to suppose that if we can find a means of healing this social breach, that we shall then have an end of all social strife or war; both international and interindividual. And what better plan can be thought of if not that of bringing all nations and all peoples under some bond of unity which secures peaceful relations, not only among the nations but among the people which compose the nations? And what is this if not democracy? This proposed league of nations being true democracy so far as it goes, the next step should be to put it on trial, first internationally, leaving the people within each nation to work out their own salvation thru experience. If democracy should prove to be an efficient remedy for international strife then why may it not succeed as a remedy for those internal movements called radical socialism, the I. W. W., and Boshevism; all of which are undemocratic to the extreme simply because they divide the people into contending factions.

A number of U S. senators have found faults in the present form of this league. They say: "It will render impotent the Monroe doctrine; it will deprive the U. S. of the power necessary to self-defense; it opens the door to the internationalism of Lenine and Trotzky, which is nothing but Bolshevik anarchy; it violates the traditions of Washington and Lincoln, because it is an entangling alliance with foreign powers and because it abridges the sovereignty of a government of the people for and by the people; and it is the greatest triumph of English diplomacy in three centuries because it gives that nation five votes to our one on account of the five English colonies.

These are the principal objections to this league so far offered and known to me; and it it is certainly a surprising thing that men of such narrow vision should be permitted to take part in the senate deliberations of one of the most enlightened nations on this globe. The fact that such men do have a voice in senate proceedings makes it clear that the people of this country either do not know the true principles of peaceful social relations, or if they do, they are afraid that the progress of true democracy will interfere with their own private interests. In view of a well considered world democracy to be described in this chapter, not one of the above objections have any validity. Instead of nullifying the Monroe doctrine this league will extend its jurisdiction to the entire world, besides making it more secure than heretofore, simply because it guarantees the independent self-government of each nation. The power of this or any other nation to defend self will not be necessary because each nation shall be bound by law to respect the legal rights of every other nation and the combined power of the world shall be at the service of all, great or small. All disputes shall be settled by an international court of justice the same as in a community of individuals. This league does not open the door at once to international Bolshevism. As will appear later all such movements are premature, misguided and most decidedly undemocratic. The world was not made in six days. This league does not violate the traditions of Washington and Lincoln, because, as everyone must know, an entangling alliance cannot rest on the fundamentals of true and pure democracy; and because a government of all the people, for and by all the people, must be, to some extent an individual, self-governing democracy. An impure democracy may fail in its self-government because of insufficient knowledge of the principles of peaceful social relations. The British empire may be the largest and most powerful of the independent nations but the constitution of this league guarantees the territorial integrity and political independence of small nations the same as large nations. The power of the world can be used only to enforce the constitution and this must be framed to secure justice to all alike.

No doubt this constitution may require amendments in certain parts, but beyond question the issue is now plainly before the people and they have only to choose one of two alternatives; either go back to the old state of endless strife or adopt and put in force some principle of social unity which will make such a state impossible. If democracy is to be the savior of the world then let us clearly define it and make sure that we know what it is. The following is a draft or statement of the principles of pure democracy as they appear to me from the stand point of this theory of life or philosophy of things.

Preamble—A primary and necessary condition of all social life, that of the animals as well as of men, is, that it must contain evil, as well as good, during its evolutionary stages, in order that something good may be gained in the end. In all the struggles of life the good things are gained thru experience of good and bad, and thru selection and retention of the good; and we must have this experience in order to learn. Knowledge is that which guides the energies of life in the way necessary to gain the good and avoid the evil, and ignorance is lack of knowledge. All the evils of life are either a direct or indirect result of ignorance and all good in life is either a direct or indirect result of the use of knowledge. So it is that the more knowledge we possess the better we are able to get aloug in all the pursuits of life. A common trait of all animals and to a great extent of men, is self-interest, as against the interests of the social body of which they are a part and without which they would not exist. The animals of course are to be excused for their ignorance but not so with men. As a result of this trait life has always been a struggle for the possession of the things useful to man; such as wealth, power to rule, supremacy etc. There are those who get a great deal more than they actually need, those who manage to get enough and those who spend life in a desperate struggle for existence. As a result of this struggle society has always been divided into at least two great classes;

the rich and the poor; the rulers and those who are ruled; the autocrats and the democrats; those who would keep the people divided and in perpetual strife and those who would keep the people united in peaceful brotherhood. This social division, disagreement and contention, is more or less evident in all forms of life from the lowest individual up thru all aggregates of individuals into states, nations or a society of nations. As a result of the progress of knowledge democratic rule is gradually taking the place of autocratic rule and it is well to know the principles of unadulterated democracy.

Article I.—In itself, space is nothing In its relations to something, it is an object of consciousness. Something is first, matter or substance, second, the motion and mind of matter or substance, third, a vast number of things due to differences and relations in matter, its motion, and its mind. Life is the conscious activities of the mind of matter in relative motion. The word democracy is herein used as a general term meaning the principles of life—the laws which, when put in practice, will make secure the agreeable relations necessary to happiness.

Article II.—Life is possible only in a mental organism. A mental organism is an association of mental elements, individuals, families, tribes, states, nations or an association of nations, to some extent organized and active, for the necessary purpose of securing ageeable relations in the activities of life. To the extent that the mental elements, individuals, families, tribes, states, nations or associations of nations, are imperfect in themselves, or to the extent that they are lacking in knowledge and in the cooperative organization necessary to happiness, to that extent life is a failure. The proper office of knowledge and democracy is to root out and destroy this evil.

Article III.—Every thing that lives, animal or man, and all the higher aggregates of animals or men, must occupy and manage as well as knowledge permits, a small portion of this material universe in order to properly manage and use its material parts. In the animals and men this small part is called the material body. In the families, states or nations it is called the territory occupied by the family, state or nation. For the same reason this entire material universe must be occupied and managed as well as knowledge permits by a mind of Supreme intelligence and power, properly called The God of Pure Democracy. This is the end of mental evolution; the highest attainable perfection of the mental organism; the one Individual Supreme. Thus we have a series of individuals from the lowest to the highest, each in itself possessing a portion of this material universe as its own and without which it would not exist, each in itself possessing the same form of self-government, the scope and efficiency of which must depend upon the extent of its own knowledge and intellectual development on the lines which lead from the lowest and most adulterated forms of democracy upward toward the highest and purest form of democracy. Every thing that lives is therefore a democrat to some extent—more or less contaminated with selfish, autocratic ignorance,

Article IV.—Most people have learned from experience the great value of intelligent self-government. There are two forms of self-government which should be carefully distinguished in our analysis of social phenomena; (1), individual self-government; (2), social or national self-government. In the first named the individual seeks to adjust the relations of all his mental elements and all his possessions, using all the knowledge and means at his command, first, to secure agreeable relations within self, second, to secure to self alone as much of the good things of life as possible, and with little or no regard for his true relations to the social body of which he is a part and without which he would not exist. In the last named the individual seeks to adjust the relatioms of all his mental elements and all his possessions, using all the knowledge and means at his command, first, to secure the most agreeable relations within self, second, to secure the most agreeable relations within the social body, of which he is a part and without which he would not exist.

The first above mentioned is the animal individualism of past and present—a relic of the dark age of brute ignorance, autocracy and slavory in human history. The last named is the Humanism or Socialism of Christianity, which holds forth the bright promise of a pure Democracy, in which all men are free within the limits consonant with human life. It must be seen at once that these two forms of self-government are conspicuously antagonistic. Both cannot exist on terms of agreement in the same social state or form of government, simply because the first named divides the people into contending classes, the one class ruling and the other class ruled. This class distinction has been proved time and again, all over the world and in all the past history of political and economic life. And so it is today.

Article V.—The autocratic form of government divides the social body into contending factions simply because it allows the more industrious or ambitious class to take the advantage of others in the struggle for possesson of the things which all men need and must have in order to live. These things are properly called public and private utilities, or useful things. Public utilities, in the largest sense, are all existing things viewed collectively and which we call the universe. Each individual must have the universe to live in, just as it is; but he cannot have it all to himself Private utilities are the things which each individual must have for self alone so far as he does not use them to deprive others of the same rights enjoyed by himself. The material body of every man or animal, and a part of the earth's surface necessary to the support of the individual, family, tribe, state or nation, must be regarded as private property, in so far as it is not used to interfere with the same right of others. It is thus clear that there is, and must be, a legitimate limit to the spheres of public and private property, in each possible case, but exactly what these spheres are, or where the line should be drawn which separates the two, can be determined only by the righteous enactment of state and international laws, under a pure democracy as herein described. From this view-point it is perfectly clear that the world today does not contain a single example of a purely democratic form of government, The most democratic nations of the world, the British Empire and the United States, still permit their subjects to accumulate vast fortunes, which far exceed their utmost needs, and this too without the least restraint; even in many cases abetting and protecting a privileged ruling class who gain the power to rule thru privately owned public utilities. Every system of government on earth derives its power to govern under present undemocratis laws and thru the private ownership of public utilities. All public and private utilities belong to the earth; they are part of the earth and so is everything that lives within and beneath the earth's atmosphere. If one half of all the people owned the whole earth, they would not only own the other half of the people, but would have the power to govern them and even the power to enslave them; and just to the extent that the governing class are not humanized, christianized or civilized, to that extent they will strive to own and enslave the other class. The direct cause of all wars and all disruptive tendencies in the social body, is thus conspicuous, and this is autocracy, the one thing which divides the people into warring classes; and every man or association of men, who privately owns or aspires to the private ownership of any part of the public domain or any thing isdispensable to all the people, is an autocrat.

Article VI.—That form of government properly called pure democracy unites all the people into one sane, self-controling, unselfish, peaceful community. In the words of Abe Lincoln, it is "a government of the people, by the people, for the people." The soul of pure democracy is self-government, both individual and social. First, the individual: Any man or woman who always takes the best possible care of every part of self, by using all the knowledge and means at his or her command, and with due regard for the same democratic rights of others, is a good democrat. On the other hand, any man or woman who fails to perform this service for self, who has fallen into the habit of overworking or abusing or neglecting any part of self, for the undue gratification of some other part, and who fails to respect the democratic rights of others, is not a good democrat. Next the family, state or nation. Any family, state or form of government, which always takes the best possible care of every part of its social body, by using all the knowledge and means at its command, and with due regard for the same democratic rights of other families, states or forms of government, is a true democracy. On the other hand, any family, state or form of government, which fails to perform this service for the social body, for every class or part of its social organism, which permits the practice of overworking, abusing or neglecting any part for the undue gratification of any other part, and which fails to respect the democratic rights of other families, states or forms of government, is not a true democracy. If democracy is not this it is not self-government. The efficiency of self-government is directly dependent upon the knowedge of right and wrong which controls the power that governs. The misuse of this power is a direct result of ignorance, the common progenitor of autocracy.

Article VII.—A summary of the primciples essential to the democracy of life is the following.—

1. This universe of things, as a result of the differences and relations in matter, motion, mind.

2. The mental organism, both individual and social. In the individual the organism must consist in an association of mental elements, to some extent democratically organized and active, for the purpose of securing agreeable relations within self. In the society the organism must be an association of individuals, to some extent democratically organized and active for the purpose of securing agreeable relations within the social body.

3. The thought and labor necessary to the use of the materials and forces of the earth, in the production and distribution of the things useful in life; and capital as a medium of exchange and a measure of the value of the things useful in life.

4. So far we have in outline, the industrial machine, both individual and social, and which is indispensable to the life of man. In the body of the individual all the organs and all the means of production and distribution of the materials necessary to the nourishment of every part of the body, also, all the means for the removal of waste materials, are properly called public property because they are indispensable to the life of every part and of the whole. No part of the body can appropriate to its own exclusive use any part of that which has been designated as public property without injury to the other parts. In the social body all the productive, distributive and waste-eliminative resources of the body are public property because every individual must have the use of them. No individual can appropriate to his own exclusive use, any part, or the whole, of that which has been set aside by a civil democracy as public property.

5. As to what public and private property is, it may be said that any one thing which all the parts of the individual body, or all the individuals in the social body, must have the use of, and which cannot be divided equally among all the parts or all the people, must be regarded as public property. For example, the heart, the arteries veins and capillaries, which constitute the vascular system of the individual body, along with all the other vital organs, moving organs and sense organs, in short the entire material body, with the mental organism necessary to its operation, must be regarded as public property to more or less extent. As examples in the social body may be mentioned the streets and alleys in towns and cities, country roads, railroads, express service, telegraph and telephone service, water ways of transportation such as rivers, canals, lakes, seas and oceans, mining and agricultural resources, in short the entire earth, with all the people democratically organized in one great society of nations, in which there is no such thing as private property in the exclusive ownership sense. It may be supposed to be strictly in accord with justice that every man should have exclusive right to the use of his own material body to the full extent of his ability; but under pure democracy such liberty is not possible simply because every man's body is a part of the earth, given to him under the universal life conditions which require the most careful use of that body in all ways essential to the well-being of not only self but of the life of the universe. To serve God there is no better way, in fact no other way.

So it appears that there is no such thing as private property in the sense that gives to the individual the exclusive right to do as he pleases with his own body or even with a single atom of this material universe. But there is such a thing as private property in the sense that gives to the individual the exclusive right to the use of his own body so long as his use of it obtains benefits not only for self but for the social body of which he is a part and without which he would not exist. The difference between public and private property can thus be readily and clearly determined and to do this in each possible case is the business of a strictly impartial, democratic legislation. The failure so far in human history, to understand, to recognise and put into practice this important difference, has been the direct cause of all wars and contentions among men.

A pure democracy, therefore, is simply that social state, individual or national, in which each part of the individual, each individual, or nation, gives to the social organism all he is worth to that organism, and receives in exchange a just compensation. What he receives should be the exact measure of what he is worth to the world. More than this is not his by right.

The powers of life consists in wealth of bodily and mental vigor, and of things useful in life. The misuse of power results from that ignorance of pure democracy which always begets autocratic rule, social disruption, strife and oppression. The revolutionary movements called Bolshevism, the I.W.W. and radical Socialism, are giving the world striking examples of this tendency toward the misuse of power, as a result of inefficient self-government. Yet these agitations are a power for good in the education of the people on the lines which must eventually lead to a purely democratic state. They are a God-given lesson to the people exactly as the great war in Europe, now just ended, was a lesson to the people. But will they learn?

History repeats itself in no wise more instructive than in that of the continued discontent and frequent uprising of the people against the misuse of power in the hands of an ignorant ruling class, and the revolutions just staged in Russia, Germany, and Austria-Hungary, are certainly well calculated to stamp deep in the public mind a lasting conviction of the truth of the situation. The Bolsheviki movement as described by the best available authority is.— Dr. W. C. Huntington, formerly commercial attache of the U. S. Embassy in Petrograd, testifying before the Senate Judiciary Committee, Washington D. C. says: "Bolshevism, from a study of the literature of the movement and from observations of its practical working is as follows.—

"The present state of the world is unsatisfactory. Wars and the evils besetting society are due to capitalistic classes. Humanity is unable to cope with capitalistic society and get justice. The capitalist must therefore go. Difficulty arises from the fact that those who possess anything are unwilling to give it up. Socialism, so called, has failed because it has proceeded upon parlimentary lines. Compulsion must be used. The state must own all. There will be no property and no private owners. All will be government servants, and, by removing the temptation of money-getting, war is obviated."

Regarding the aims and results of Bolsheviki rule the Dr. says: "Bolshevism is the enemy of all established governments and seeks their undoing, including that of the United States. Internationalism is at its foundation. The practical effect upon Russia has been utter chaos, anarchy, cruelty, economic paralysis and practically a return to barbarism."

The above, when compared to other similar reports from different sources seems to tell the truth so far as it goes, but it does not tell all. From the official literature of Bolshevism we learn that the present government of Russia is an "Industrial Republic," the first government of the working class in the world, owned by the workers and for the workers. It is called a government of Soviets. Instead of electing men at the poles they are elected in the shops and unions of organized labor.

Each department of labor has its Soviet and it selects a delegate to the All Russia Assembly which meets about every 3 months at Moscow. Here all public questions are discussed and decided. There is now about 1500 delegates from all Russia.

It is true, as officially reported, that the Soviates do not allow everyone to vote. "The exploiters of labor, idle people living off interest, members of the Czar's family, criminals and the insane, are not allowed to vote in Russia. The Soviate slogan is: A vote for everyone who works."

The one great mistake in this movement, which has brought to it serious discredit and censure, and which has made of it a most decidedly undemocratic procedure, is the fact that it has disfranchised and even put to death a large part of its population. The family of the Czar, including a number of innocent children, and thousands of the nobility and the rich people were shot to death because they were opposed to the Soviet form of government. From the beginning of the Bolsheviki revolution (Nov. 7th, 1917) to Jan. 1st, 1919, 4,500 people were executed for the same reason. "We kill to make men free," is the idea in Russia, and can we wonder in view of the facts. For hundreds of years, under the Czars the Russian people have been oppressed to the limit of endurance and revolution and retaliation was the inevitable result. Under the Czar, and during the first year after the 1905 revolution was put down, 32,733 of the people were executed. And so it goes. Abuse a dog and he is liable to bite you; treat him well and he will love you. Every black page in human history is a direct result of this struggle between misguided authority on the one side and misguided liberty on the other—both a direct result of ignorance of the principles of pure democracy. In the late war between Russia and Germany it was necessary to arm and discipline millions of the Russian people. After many thousands had been killed in battle fighting to defend one ruthless form of autocracy against another, the Russian soldiers and working people decided to quit; hence a successful rebellion which put the Czar and his associates out of power. This was undoubtedly a splendid move for democracy. The only remedy against blighted and blighting autocracy is revolution. But the people went too far. There was nothing to prevent them staying under Karensky and establishing an impure democracy like that of the United States. Then by majority vote of all the people they might have reached the goal of pure democracy. A pure democracy is, and must be, a government of all the people by all the people, and the will of all the people must be expressed by the ballot. The old idea that a majority of the people may be as despotic as any absolute ruler, is tenable only in view of the fact that a majority of the people are totally ignorant of the principles of democracy and so incapable of self-government.

A pure social democracy is a complete individual mental organism, which knows the use and place, and strives to hold unimpaired every part of the social body exactly as any intelligent person always aims to hold intact every part of his own body. No rational man would cut off and destroy his right hand simply because it is disabled or in any way defective or inefficient for its rightful cooperation in the activities of all the parts as in the perfect life of the individual. Rather would he preserve and if possible restore it to its proper place and use in the bodily economy. At least he would do all he could to keep it from annihilation. And so with the rational democratic social state. The imperfect democracy is responsible for all the crimes of humanity and no democracy can be pure and perfect if it permits the killing of its people for any crime whatever. Under the code of Christianity the vilest sinner may return. Murder is not reformation. If it were impossible to cure bad habits it would be necessary, not to kill people because they are bad, but to put them where they could do no more harm.

It seems certain that there are few people in our present social state who can understand that there is a moral limit to the attainment of wealth. The inconvenience of poverty, the allurements of wealth and the protection and encouragement of man-made laws, have developed in man, as in the animals, the habit of industrial individualism, which is an essential part in the program of human evolution. This was necessary in the making of the animal man, but it is now a serious hindrance in the making of the human man. Natural selection, heredity and survival of the fittest have contributed to bodily vigor, beauty of form and intellectual development; and so it is that the most favored individuals of each generation in each line of descent, have survived in greater numbers thus improving the species. And so it comes about that all the higher animals including man have been able to advance to their present state of existence. This, in brief, is God's plan of creation, to be further considered in book 2.

In every line of descent there is always the strong and the weak, the feeble, infirm, frail, wanting resolution, and the robust, resolute and generally succesful in whatever they undertake; and hence it is that there is a natural class division in every social state, animal or man. The one class rules and the other is ruled, and as a direct result of this social division we have all the well known social evils, from the milder forms of the industrial exploitation of the ruled by the class that rules to the extremes of cruel inhuman opression.

Autocracy is as old as the animal kingdom and it has an essential part to play, not only in the making of the higher animals including man, but in the making of the nations. But in the natural course of human evolution a point must be reached at which the highest beings must become more and more alike. There is but one moral law, one principle of justice, one pure democracy, one Kingdom of God. These are only different names of the one great principle of life. The problem of human evolution is extremely simple and it is only necessary to understand it in its present stage, in order to know what to do in order to keep it going. It is now a simple matter of the right use of the principles of democracy and the first thing to do is to enforce and maintain a complete unity of the present social organism with all its imperfections. The severance of any part in any case wherein a cure or a reformation is possible, is undemocratic. Loyalty to the present constitution is a first principle of pure democracy exactly as self-preservatisn is a first principle of life.

The next thing to do is to seek out and carefully apply every available remedy for social evils. No one can dispute the fact that the most notorious and perpetually menacing social evil, not only here in these United States but all over the world, is that which directly results from the fact that labor and capital, the two most necessary factors of industry, are not now and never have been, organized and managed on a national scale so as to work together for the benefit of all the people. This evil is undeniable and the remedy is equally conspicuous but the people do not understand the remedy and they will have none of it. When a man is sick he knows it because he feels that way. He has faith in the doctor and in most cases the doctor can help him. The social body is sick all the time and everybody knows it but they have no faith in doctors, no use for remedies and so they stay sick. That there is something wrong in the social body no one doubts. The public press all over the world contains its daily output of reports of labor strikes, riots, impending revolution and all the common forms of social disease. A general strike movement is now sweeping Canada from the Atlantic to the Pacific. Canadian labor is closely affiliated with the American Federation of Labor. In Canada it is reported that the labor organizations have for several months been showing a steady trend toward a form of industrial unionism similar to that of the I.W.W. in this country and now put in operation in Russia. This move is regarded as dangerously significant. It is admitted by those who claim to have inside information that a widespread strike, involving all industries and even approaching a revolution the same as in all Europe, is a clear possibility in America.

And the reason. The frenzied "get rich quick man," with a highwayman's sense of justice and no respect for any one not worth skinning, is still doing business in the old famillar way, and a suffering public is still sending forth its never ceasing howl of distress. Since the war began retail prices of all the necessaries of life have advanced nearly a hundred per cent yet no proportional advance in wages for labor can be noticed. And is this high cost of living altogether a result of war-time conditions? No. Millionaires have increased in numbers faster within the last four years than ever before in this country Of course the social chasm has grown wider and deeper, for on the one side the destitute suffer in silent dread, while on the other there is abundance, luxury and profligacy. Think of this Salaries for labor, even the highest, never make the millionaire. There is one and only one simple way, and they call it profiteering—the management of labor, money, materials and force, in the way that brings large returns in money. This is "Americanism. Big Business," and it has assumed a variety of forms going under a variety of names as the exploitation of labor in production and distribution, speculation, tricks in trade, gambling and theft.

We sometimes hang a man for stealing horses and it is not always easy to catch him. But how about the food profiteer? He goes about his business as free as air, skinning people everywhere, and loudly boasting about it; yet he is worse than a horse thief because he subjects helpless children to slow starvation. If this is a government of the people for and by the people why don't the people do something. The truth is, the majority of the people are so infatuated with habits of industry, so besotted with the fooish passion for wealth and so ready to take hold of any project that promises great gain for self, in two words so utterly selfish, that they are not able to get together on some plan of cooperation that secures justice to all. The American people either don't want government interference and restraint, or they don't know how to get it. Nearly everybody is either rich or wants to be rich. During the war we had government control of industries forced upon us as a war necessity. In an emergency like war all the people and the country's resources must be united to beat the enemy, and united action is possible only under the one and only principle of government properly called social self-government—the central administration of the power that governs. But this government interference was a series handycap to private enterprise. Now the war is over and the people want no more of it. They want to be free to resume the old game of American life—skin or be skinned.

It is now the common belief that any political party that advocates the permanent establishment of any bureau or agency for government control of industries, will not have the support of the people. No doubt; but when I say 'the people,' I do not mean all. There is a considerable part of the people who would do anything in their power to secure universal peace but they do not know what to do. There is another part of the people who do know what to do but they are far in the minority.

To these people, no doubt, president Wilson had reference when said in his address to the International Law Society in Paris that "we have been wrong because we have not recognized that the heart of humanity beats under plain clothes and by humble firesides. Those who lead hard lives are to be consulted and cared for." True, and it was this and similar utterances from the president that aroused the protest of the predatory interests. The following rather lengthy quotation is from an editorial in a leading paper which evidently belongs to a class which has been called "the capatalistic press," and which passage is representative of a great deal of like purport that may be found in many papers thruout the country, and which, no doubt, must have a strong influence upon the public mind.

"The president is undoubtedly correct in supposing that a momentous change has come over the spirit of most employers in relation to their employes. No longer does the average manufacturer experience spasms of pain every time he raises a man's pay or puts in a rest room or provides some comfort for the female workers of his force. Probably this is due more to the discovery that such acts pay well on the investment than to the excited ravings of authors and teachers. Yet if the president means that the heart of humanity under plain clothes and by humble firesides knows better what is good for it in a commercial and industrial way than the heads of experienced and trained men of business, then he is not only wrong in theory but offers a considerable contribution toward the cause of still plainer clothes and humbler firesides. If he means that business should be run from the shops and not from the office, then he has much to learn about business, however shrewd he may be in politics and diplomacy. When this sort of gospel has matured and fruited, it brings forth exactly what Mayor Hanson of Seattle justly pronounced an element in society for whom we should prepare cemeteries instead of conferencs. Too much in the past we have been given by penalizing the man who knows enough to make 10,000 jobs grow where one grew before. What we want now is to give these geniuses and benefactors of the plain clothes and the humble fireside more scope for their operations, instead of taking away from them, not only the power to do things on a colossal scale, but also the incentive to do so that is involved in the enjoyment of the fruits of their enterprise for themselves and their descendants. Higher wages, profit-sharing, welcome for friendly requests for improved working conditions—all these are coming in apace and mean much for the benefit of capital as well as labor; but to destroy the control which exceptional ability exerts over colossal enterprises will be to kill the goose that had laid the golden egg of progress and prosperity for the happiest, the most intelligent and most efficient body of labor in the world today or at any time in the history of mankind." (Rocky Mountain News, May 25 1919.)

The above is certainly a strange jumbling of fact and fallacy. It is true that the heads of experienced and trained men of business are necessary in the management of industries great or small, but it is not true that the manager must own the business and be free to manage it to suit himself. It is true that a shrewd manager can make millions for himself when he owns the business, but it is not true that he can do this when working for some one else on a salary. Many cases proving the truth of this statement and the fallacy of the claims of the above quoted passage are at hand. Mr. Charles M. Schwab became a multomillionaire by his management and private holdings in the steel industry; but as manager of the ship-building industry he served the government on a salary less than that of the president, and ofcourse he did not make a fortune on this, yet he performed his service and proved his ability just the same. Mr. McAdoo is another example. He proved his fitness as railroad administrator and received only a salary. He did not own the roads and the government held them only under a leace. The president of the United States can and does serve his country with honor and is satisfied with a salary of $75,000 a year. Cabinet members $8,000 Senators 5,000. So far not one of the presidents ever became millionairs. Jefferson was oblged to sell his library to keep out of the poor house and Monroe died so poor that he had to be buried at the expense of his relatives. Yet we have it from a trustworthy source that the millionaires of this country have increased more rapidly than our national wealth. "We have created 16,696 of these huge fortunes in the last ten years, most of them in the last four years." (Senitor Capper of Kansas, in Benson's "Reconstruction." June 1919.)

It is true none the less that the majority of the business people of this country will believe the above quoted statements. In fact it is the real sentiment of big business daily set forth in the capitalist press thruout the country. In a speech at the Reconstruction Congress held at Atlantic City last December, Mr. Schwab explained his business creed as follow.

"The real development of any great enterprise depends on the individual initiative of the American business man. I do not believe we will ever get the full economic development of any great branch of American industry that is not developed under private enterprise and under private capital. I am one who believes in the fairness of American labor. I am one who believes that the only foundation upon which anything can permanently rest is the economic use of everything, whether it be labor, materials, manufacture or what not. Any foundation of organized labor or capital that is on a false basis must fall."

Here again we have a muddling of truth and fallacy most surprising. Surprising because it comes right from the brain of one of America's successful and most efficient men of business. It is true that the successful carrying on of any great industry or undertaking, must depend upon the individual managment of a competent person or cooperating body of persons, but it is not true that the complete success of any such undertaking must depend on private capital and private management. It is true that the only permanent foundation upon which any form of industry can rest, is that which employs labor, capital, and force, (in the changes of raw materials into useful things, and in the transportation and distribution of useful things,) in the way necessary to compensate each person concerned according to the value of his service; and it is not true that any other foundation can be permanent. Capital is a useful thing—a measure of the value of, and a medium for the exchange of, other useful things. When the capital, material and means of production, necessary in any productive industry, are owned and managed by one or a few persons, they have the power to fix prices on labor, materials and finished products, in the way that will bring them large profits; and so in all the forms of industry. To get rich the two things most necessary are capital and business ability Everybody knows this and most of them do not seem to know anything else. The present capatalistic foundation of American industry is that which, under private capital and private management secures exorbitant profits. This is the self-confessed foundation or system that makes the millionaires, that divides society into contending classes with all their attendant evils. If democracy and peace is the end of social evolution the foundation of American industry is false and it must fall.

THE END OF BOOK ONE

[NOTE: The new electron theory of the atom and of the nature of electricity, now holds the general attention of scientists and philosophers. This book was set up and electro-plated before I heard of the electron theory. Here I wish to mention my belief that all the phenomena of radium or radio activity, may be accounted for as due to mechanical electric repulsion as described in Chapters 5 and 6, this dook. (see appendix book 2.]

APPENDIX TO BOOK ONE

A CRITICISM OF EINSTEIN'S THEORIES OF RELATIVITY AND GRAVITATION

—PREFACE—

The Scientific American Publishing Company of New York is now publishing a book entitled EINSTEIN'S THEORIES of RELATIVITY and GRAVITATION. The object of this book is to prepare the mind of the layman for the reception of the Einstein theories. These theories are said to be not more difficult to understand than other scientific theories when once the mind is prepared for them. The general reader who thinks in the ordinary ways of common sense is lacking, not only in the necessary vocabulary, but in the mental background on which to base the vocabulary; hence his liability to shock.

This book contains the $5,000 prize essay (which prize was offered for the best explanation of the Einstein theories) also the best thought of the 300 contestants for this prize, along with a large amount of editorial matter; and it is offered as the book of all books for the layman; and for the philosopher, it is the one book to afford a mathematical basis for his speculations.

Now, the object in this pamphlet is to offer a just criticism of the Einstein theories. According to reports Einstein has employed the advanced calculus in his work and there are only a dozen men in the world today who can understand him.

The object herein is to make it plain that the true theory of the universe must be worked out by a process of reason, and that reason is only a higher development of ordinary common sense. When the rational theory is once complete, then and only then, the mathematician may apply his formulas as a conclusive test. Another object of this pamphlet is to advertise a new work of SCIENTIFIC PHILOSOPHY. This work is now complete in one volume of 700 pages and ready for the press. The relativity of Hamilton, Mansel, Bain and others, along with the Newtonian Mechanics, has been amended and applied to the entire universe. As examples of this application a new form of the ether medium and a new theory of gravitation are described.

From rational relativity and from Newton's laws of motion, and in order to make this physical universe complete and secure, it is necessary that all that part of it which lies within and beyond the range of the best telescope, and which is now in active motion, should be enclosed on all sides by motionless matter. Or at least should be completely environed by something which is so constituted as to prevent the ultimate diffusion of the inner and active portion. Whether this outer substance be an absolute solid, whether it consists of closely packed particles having no motion, whether there be anything outside of it or whether its limits terminate with an abrupt surface, are questions which we need not try to answer at present. But that the universe of life and energy which consists of ponderable bodies floating in a vast sea of ether, the expansive energy and outward pressure of which must be greater than the highest estimate of man, is limited on all sides by matter which does not receive its motion, is a mechanical necessity which challenges recognition.

This conclusion, tho not acceptable to many critics, is far less inconsistent with known physical facts than the idea of an inscrutable power of attraction, which acts in empty space, in order to hold together the substance, and maintain the life, of the universe; and since the most powerful telescope has failed to reveal any limit to the ether medium perhaps the mind of man may never reach it in any other way.

See the illustration on page 23 of this pamphlet. It does not mean that the universe must be a perfect sphere; but it does mean that like the hen's egg it must have a shell or a solid exterior to preserve its life and democratic utility. In this system all the facts and all the mysteries known to physical science, have been explained and united undear the laws of motion now recognized as the basis of all astronomical calculatins. The only assumptions necessary to start with are, an atomic ether medium and a limited universe as above described.

— § I —

MODERN PHILOSOPHY

We are not missing the truth very far when we assert that, for the average reader, philosophy is the most uninteresting of all subjects. From press reports we learn that profits from the sale of the works of Herbert Spencer, said to be the worlds foremost philosopher, and which works are contained in eight or ten large volumes, never exceeded $8,000 a year. There are many scientific, historical and religious books which have overreached the million mark, and books on fiction, with nothing in them but creations of the imagination, have far outstriped everything else. Of the eight recent books by Harold Bell Wright over eight millions have been sold, and returns are still coming in. Zane Gray's latest books are now selling at the rate of 5,000 a day. To my knowledge there are two philosophical magazines published in the United States, but I have never seen one of them on any news stand while the story and photoplay magazines are there in attractive dress and great variety.

What's the matter with philosophy? If I put this question tothe present day philospher he tells me that the human race is still in its juvenescent stage of mental development, and so not able to grapple with the deeper questions of life. Man, he says, has not yet freed himself from his native common sense frame of mind, and of course his thinking is only that which concerns the ordinary affairs of life. What he needs most is to be touched by the regenerative influence of the real philosophy now being taught in the colleges. This so-called real philosophy has no use for common sense except as the object of its uplift. I might quote from the writings of more than a dozen of the professors of philosophy in the high seats of learning in the Unitsd States and Great Britain, to justify this statement.

No doubt the human race is still in its necessary stage of adolescence, and modern science and philosophy, so far as they are concerned with ultimate truths, are in the same fix. For my part I am strongly impressed with the idea that present day science and philosophy, in particular the last named, in their search for fundamental truths, are far behind the most ordinary common sense. The true system of philosophy must rest on principles—indisputable fundamental truths which are known to be true by the best known criterions of truth. The present situation is simply this: The world has no philosophy and never had, and until it has, no one but a narrow specialist can find it interesting. All the scientists and philosophers past and present, have confessed their ignorance of the fundamental truths upon which the true system must rest. A system of philosophy without a foundation of truth is not a system and ignorance is not philosophy—not according to my understanding of the subject.

In as few words as possible let us review the present tendencies of science and philosophy. The doctrine that matter ultimately consists of immaterial electrons or small charges of electricity which play the part of atoms and molecules, now holds first place in speculative thought. But leading authorities appear to disagree somewhat as to the nature of the ultimate atom. One prominent author says of the ether and the atoms:

"When I say that matter is atomic I do not mean that ether is atomic. I hold that ether is most certainly not atomic—not discontinuous; it is an absolutely continuous medium, without breaks or gaps or space of any kind in it, the universal connector; permeating not only the rest of space but also the space occupied by the atoms themselves. The atom is a something superposed upon, not substituted for, the ether; it is most likely a definite modification of the ether, an individualization with a permanent existence and a faculty of locomotion which the ether alone does not possess."

This author thinks that electricity is not a form of energy. He says: "Electricity may possibly be a form of matter—it is not a form of energy. * * Understand the sense in which I use the word electricity. Electrification is a result of work done, and is most certainly a form of energy; it can be created and destroyed by an act of work. But electricity—none is ever created or destroyed; it is simply moved and strained like matter." ("Modern Views of the Ether and Electricity," By Oliver J.

Lodge, Professor of Physics in University College Liverpool.

Another brilliant scientist of England, Dr. Hugh Elliot, in his recent book "Modern Science and Materialism" has expressed the belief that common sense is an obstacle to the progress of physical science. He thinks the first step in the real progress of modern physics must consist in the resolution of our common ideas of matter into the new idea of "disembodied electrical charges. Electricity, he says, 'is one form of energy. Light and heat are other forms of the same energy and they traverse the empty space between the earth and the sun without any basis of matter whatever.' And so with all the forms of energy. This assumption rules out the present distinction between matter and motion, or matter and physical energy, and substitutes for it positive and negative electricity—positive electricity playing the part of energy and negative electricity taking the place of matter. It is not denied that motion or physical energy plainly manifests the characteristic which we call inertia but it is assumed that there is such a thing as immaterial inertia. And tho it is admitted that we have not yet reached a complete solution of any of the great mysteries of physical science it is insisted that this doctrine has brought us far nearer to that complete unification of knowledge which is the goal of philosophy.

So much for the drift of English science, and it is the same here in America and in fact all over the world. But the most noteworthy contribution to this tendency has come to light in the last few years. Dr. Albert Einstein a German mathematician, fifteen years ago worked out a Special Theory of Relativity which attracted the attention of mathematicians but was generally regarded as of little importance. During the late war Einstein developed his special theory making it broad enough to be called a General Theory which is supposed to include the Universe and so to pave the way to a true philosophy.

Within the last two or three years this general theory has aroused the attention of scientists an mathematicians to an extraordinary extent all over the world. Many of those who think they know all about it are now making big money trying to show the rest of us how to understand it. A wealthy American now living in Paris offered a prize of $5,000 for the best explanatory essay on the subject. The contest was lively; 300 competing essays being offered from all parts of the world. A Mr. L. Bolton of England was the winner. The prize was offered thru the Scientific American, New York, and they have just issued a book containing the winning essay and other matter selected from other contributors and by the editor.

It would be impossible for me to offer an adequate review of this book, besides, it would not be safe to try it because I cannot understand it myself. I will only attempt to mention a few of their results and to explain why I cannot feel assured that I understand them. What I say here is only my opinion.

Page 27.: "The results of observation are the raw material of physical science. The finished product is obtained by the bringing together of a large number of such observations with the view of obtaining some generalization to be finally established by a simple mathematical formula. This formula is then called a law of nature."

The above quoted passage, relieved of some redundance, is clear to me, and I believe it to be a correct statement of an important truth. When we have pushed our generalizations to the natural limits in any case, we can safely affirm the discovery of a natural law. There are Laws of Nature, and they are known, or can be known, to man. The one and only test for the truth of any affirmed law of nature, must be found in its sufficiency to harmonize the facts of common sense experience.

The following on the same page is not clear to me.

"Laws of nature are man's imperfect attempts to explain natural phenomena; they are not inherent in matter and the universe, not an iron bar of necessity running through worlds, systems and suns. Laws of nature are little more than working hypotheses, subject to change or alteration or enlargement or even abandonment, as man's vision widens and deepens."

The only sense that I can get from the above is this: What we call natural laws are not natural laws; "they are man's imperfect attempts to explain natural phenomena;" It may be possible to find them true in whole, in part, or it may be found necessary to abandon them entirely. Now, if this writer had been talking about methods of research I think I could understand him but he is certainly talking about laws of nature.

Page 69. "Einstein builds his structure on the thesis that relativity must be admitted, must be followed out to the bitter end. * If admitted at all, it must be admitted in toto; no matter what else it contradicts."

In a number of places it is stated that Einstein's theory is a law of nature or a principle. He says himself:

Page 288. "Every law of nature which holds good with respect to a coordinate system K must also hold good for any other system K, provided that K and K, are in uniform movement of translation." * "Light in a vacuum has a definite and constant velocity independent of the velocity of its source."

These two sentences I believe are correct presentments of what are now generally recognised as laws of nature and they are said to be the foundation of the Einstein theories. But if laws of nature are nothing but man's imperfect attempts to explain natural phenomena, as declared on page 27, then there is nothing in this entire book to support the assumption that the Einstein theory is an established law of nature.

There are a number of statements in this book which tend to discredit the Einstein theory. The following from Professor W. H. Pickering, Harvard College observatory, is noteworthy.

Page 297. "But we must not as yet conceive of the theory of relativity as a universally accepted and unquestioned truth of science. Eddington is its leading English exponent, and he is supported by such men as Jeans, Larmor, and Jeffreys. On the other hand, the theory has been severely criticised by Lodge, Fowler, Silberstene, and Sampson. Few American scientists have expressed any opinions in print on the subject, and the recent eclipse observations, to which we shall refer later, are to be repeated with more suitable instruments for verification in 1922, in hopes of obtaining more accurate and accordant results.'

In a number of other places in this book it is freely admitted "that Einstein's theory of relativity has been partly, but not completely, verified."

Outside of this book may be found damaging criticisms of the Einstein theory. In the "Scientific American Monthly" for June 1921, appears an article by Charles Lane Poor, Professor of Celestial Mechanics, Columbia University, which should be read by all who are interested in this matter. With the utmost brevity I will try to mention what this writer says about it.

"For many years the Newtonian law as applied by mathematicians has failed to account accurately for the motions of Mercury, and this failure has been made the basis of many attacks upon the Newtonian law, of which Einstein's is merely the latest and best executed. * At first sight this agreement of figures appears to confirm the Einstein theories in a brilliant manner. But striking as these figures are, the confirmation is not complete, for it is possible to explain the motion of Mercury in full accord with the Newtonian law."

Then follows a noteworthy account of well known facts all of which plainly discredit the conclusion that the Einstein formulas are necessay and sufficient, and which, it seems were overlooked by Einstein and his followers. This author concludes:—

"Thus the motions of the planets do not prove the truth of the Einstein theory, nor, on the other hand, do they prove its falsity. * It is a problem of observational astronomy to investigate the actual distribution and density of the matter in the solar lens, and to determine whether or not it approximates the conditions necessary to account for the planetary motions."

Perhaps if we knew the mechanical cause of gravitation, the as yet unexplained discrepancies in planetary movements might disappear entirely, and the Newtonian mechanics would be justified as necessary and sufficient.

A few of the other deductions from the Einstein theory may be mentioned here and I shall present them in my own words and with as little discussion as possible, giving only the pages.

Page 70: The Einstein theories are built upon first principles. Their results are a shock to ordinary common sense and we must either give up relativity or cease to follow the leadship of common sense. Common sense must be educated up to the necessary level of comprehension.

Page 99: The Euclidean and Newtonian idea that time and space are not the same thing, must be abandoned and the Einstein idea that they are one and the same, must be accepted instead in order to attain universal relativity. Time-space thus united as one should have four dimensions—time having one, a continuous line, and space three, length, breadth and depth. But do these dimensions belong to space and time, or do they belong to the real things which must occupy space and time? I have failed to find a definite answer to this question, anywhere in this book. It is admitted that all dimensions are obtained by measurements. It is admitted that space or time cannot be measured directly, and it is even admitted that they are not things in the same sense that matter is. Nevertheless it is a conspicuous fact that these people thruout this book continually talk of space and time as real things, or a thing, having four dimensions, and they have given to this substantial entity the euphonious title of "The Four Dimensional Continuum."

Page 26. "The only reality that we can know is that which we observe directly. Anything which we may think of as existing beyond the range of observation is purely conceptual." We think a great deal about space and time but we cannot observe them directly. Are they purely conceptual? and if so, how can we use them as a basis for mathematical calculations?

It is mentioned in the Monist for April 1921 that Einstein has demonstrated mathematically the truth of the curvature of space, also the fact that time may proceed in one direction in one part of the universe and in some other direction in another part, simultaneously. Here we have a conspicuous disagreement between mathematics and common sense. Our common sense plainly tells us that all calculations must begin with and proceed on real measurable things; not on non-existing, non-dimensional, unnumbered, purely imagined things. It seems clear to me that Einstein and his adherents have built on a pure assumption, in no sense capable of serving as the basis of a computation. It is admitted in this book that this postulate is entirely unsupported by experiment or observation, and that it is justified wholly on mathematical and philosophical conceptions. It may be possible to figure on a theoretical conception of the external reality and the figures may justify the theory, but the theory may not be a true representation of the reality. There are laws of nature and the one and only test for the truth of such laws must be found in their sufficiency to harmonize all the facts to the natural limits of the universe, or to some natural part of it. If Einstein's relativity can be applied to a limited whole as required by methods of science its truth as a general law will be established.

Page 35. Here is the way these people think they have overcome this difficulty. I quote their own words: "Whether we believe space and time to have real existence or not, it is obvious that we can measure neither directly. We shall have to measure space by measuring from one material object to another; we shall have to measure time by some similar convention based on events." This is the basis of their space-time four dimensional continuum, and right here we are confronted by the one question most significant in this controversy. When we measure the interval between two material objects in space, do we, or do we not, measure space? For me and I think for all common sense people, there is only one answer to this question. WE DO NOT MEASURE SPACE.

The same is true of time. When we measure the distances between objects in space or the intervals between events in time, we are not measuring real things. Space, time, all the departments of mathematics, such as arithmetic, geometry, algebra, which deal with points, lines, curves, circles, angles, ovals, numbers, magnitudes, dimensions etc. are not real things in the sense in which I have used the word in my system. In that system all things are classed under two heads: Real things and Relative things. All real things must be found in a space occupying substance properly called Matter. All relative things (space, time, and the things constituting mathematics etc.) are found only in the well known relations which they bear to real things. The distance from one object to another in space cannot exist without the objects. The interval of time between two events cannot exist without the events; in short, relative things cannot exist without real things. Nevertheless, relative things are real in a certain legitimate sense of the word. Space in its self may be an object of thought—a boundless void, in which there is no difference, no things, no relations, nothing but nothing. It is the best example of nothing that the human mind can have and there is only one nothing. Time in itself is the same *nothing*. The word 'time' is the name we have given to the duration or past, present and future of existing things. Without existing things there would be nothing enduring and of course no time. The words "time, duration, past, present and future," when applied to nothing, have no meaning. Still we must admit that empty space and empty time would exist whether any real things existed or not, and of course they must be objects of thought tho not real things. And so with all the truths of mathematics, geometry etc. The laws of computation, the truths of circles, angles, curves and right lines, are true whether such things exist in reality or not.

So it comes to this. Einstein and his follower have tried to build a system of the universe which may agree with their mathematical formulas, but which certainly may not agree with the reality. They have proved to be better mathematicians than reasoners. They have overlooked the important truth that the real system of the universe must first be worked out by a process of reason based on the facts of common sense experience, before the test of mathematics can be applied. It seems certain that they have failed to grasp the most important of all truths—the laws or conditions of existence; the fundamentals, which must be eternally true whether anything else exists or not. (Chapter II, Book 1, "The Philosophy of Things.")

Pages 33 and 34. "Space and time are concepts, and the external world is the same. We use a mechanical terminology and mode of reasoning only because they facilitate our reasoning. Two things are involved; our perceiving minds which build concepts, and the external world about which we build the concepts and not having absolute knowledge of either, we cannot affirm complete knowledge of anything." Or to put the situation in the vernacular of the common people we do not know how to think nor do we know what we are thinking about.

The above seems to de further justified by what follows. Pages 173-177. "The mathematician can think in symbols created by himself, and he can figure on them. In this he has the advantage of the ordinary thinker. He builds a coordinate system in space and time and makes use of this as a reference frame. On this he figures and brings out results which cannot be visualized by ordinary thinking. He explains this by saying that mankind does not possess the requisite faculties."

In conclusion a few more of their results may be mentioned.

"We do not explain the universe; we only describe our perceptions of its contents. All things are relative and all knowledge must be relative. There is no such thing as absolute rest nor absolute motion, and this is so because we cannot detect either by any possible cotrivance. There is nothing but relative rest and relative motion." So far as known to me it is not even admitted that absolute rest and absolute motion are a rational possibility. "In free space light presents the same velocity to all observers, whatever be the source of the light or the position or movements of different observers." The possibility of there being some mistake in the experiments is not mentioned.

From page 174 to page 180 the law of gravitation is deduced and explained from accelerated motion. It is stated that this law stands preeminent among natural laws. In other places it is called the basic law of mechanics because it covers the whole realm of physical science. This law requires a special geometry suited to the space-time, fourth dimensional continuum. The old geometry of Euclid and Newton is inefficient. How these people have managed to explain the law or cause of gravitation from the acceleration due to rotary motion, is, for me, the most difficult part of this discussion to understand. But I am not a mathematician. What follows is the best I can do.

Einstein, as quoted by Mr. Bolton, describes a rotating disk to make clear how acceleration may give rise to the effects of gravitation. On this disk stands a man accompanied by objects as in ordinary life. The disk is isolated in space so the man is not sensible of his rotary motion. But he is sensible of a force acting in one direction, and the amount of this force is in proportion to the inertia or quantity of matter in the man and in surrounding objects. The situation is to some extent similar to our own situation on this planet, but the illustration is not complete. We are not directly aware of the rotary motion of the earth and we are aware of the force of gravity. We also know of the centrifugal force acting more or less on all bodies on the surface of the earth according to their distance from the axis of the earth's rotation, and we know that this force acts in the opposite direction from that of gravity. From these facts and this knowledge it seems that they have derived the law of gravitation and here it is in Mr. Bolton's own words. "Inertial mass and gravitational mass are one and the same."

In the essay by Mr. M. Francis of New York, (page 192) the law is stated in these words. "Gravitation then is not a force at all; it is the fundamental nature of things. A body free to move must follow some definite path. According to Einstein it will move in a 'geodesic' thru time-space—in every day language, it will fall."

Other contributors in this book have made statements to the same effect. From all which I am led to the inference that there is no cause of gravitation or falling motion. A body free to move must of course follow some definite path. But suppose that it has no relative motion in itself. It has no relative motion of its own but it is free to move. If it moves where does it get the motion? Here is a better example. I am standing before a fifth story window. My right arm is stretched out of the window and I hold in my right hand a pound weight. I let go of the weight and the moment it begins to fall that moment it begins to receive relative and sensible motion from the outside. We have absolutely nothing to support the idea that a body or a particle of inert matter can create its own motion out of nothing. It is, or ought to be, a dictum of science that the sum of universal motion is constant. The law of acceleration as it applies to falling bodies is well known and it requires the velocity of falling bodies to increase as the odd numbers 1, 3, 5, 7, 9, and so on, showing plainly that gravity is a constant force acting during the descent of the body as well as at its start. Here is a question for the Einsteins. Where does the falling body get the motion necessary to start with in its downward flight, and from whence comes the extra motion which is continually being added during the time of its fall? If gravity and inertia are the same thing, and if motion is not transferred from some insensible form of matter to the sensible falling body, then we must admit that inert matter can create motion out of nothing.

From Newtonian mechanics and from common sense many similar discrepancie might be pointed out but it is hardly necsary here. All that I need to say further is that the contents of this book have encouraged me to renew my efforts to get my own work before the public. It is my belief that if the three hundred competitors for the Higgins prize would cultivate their bumps of common sense a little more they would not fail to see the futility of any attempt to explain the Einstein theories.

My review of this book is brief and perhaps not as just as it might have been, but the fact is there is a great deal in it that I cannot understand, in particular the mathematical discussions. I have no education or special qualifications for this work unless it be ordinary common sense and in the next section I shall try to explain what I think common sense is.

—§ II—

COMMON SENSE, JUDGMENT, REASON

It is a well known fact that all animals from the lowest forms up to man, must have sense communication with this external world in order to live. Thru this sense experience all first knowledge is obtained and nothing can live without some of this first knowledge. It is here assumed that there is but one universal mind, one state of consciousness for each individual, one mode of sense-perception and one method of knowledge for all living things. In the lowest forms of life this universal power of mind is used with sense-perception in guiding the individual in the many acts of self-conservation. In the higher forms, including man, it is used with the same sense-perception in the same acts of self-preservation, also in the many ways and means of obtaining useful knowledge of the world and life. All sense knowledge is relative because all things are in some way related. To know any one thing perfectly it is necessary to know all of its true relations to all other things viewed collectively. Knowledge, to be of value must be of truth and the only criterion for truth that seems available may be found in the practical methods of common sense, judgment, reason. These three are names of the three stages in the development of the one universal mode of procedure in the acquisition of knowledge. Common sense experience must preceede judgment and reason for the reason that [illegible]th are dependent on sense experience. All the lower forms of life must have some common sense in order to live and so with the higher forms. Man is the legitimate progeny of the animal world and human reason is the natural descendent of animal common sense. Nature's course in mental evolution may be readily traced from the lowest animal up to man, and thence upward to the highest of men, and in every higher step there is always and necessarily a wider, deeper and better use of the same common sense. Briefly stated the initial experience of every living thing in this life, is first, Sensations, Perceptions, Knowledge. Every new or first sensation must involve some degree of perception and knowledge. If not, it is not a sensation. In all our sensations we at least perceive and know that something affects us. What it is we may not know; that it is we do know and we must exercise some curiosity, wonder, imagination, judgment or reason, in order to decide what to do about it. What we decide to do about it will depend on the amount and right use of our knowledge of things, acquired in the past sense experience of self and ancestors, stored in our brains in the forms of memories and faculties. When our sense-perceptions have presented the same thing many times, under the same and different relations we gradually come to know that thing in a number of its true relations to other things. In this way and in the indispensable use of our common sense-perceptions, we acquire all our ideas about things. And let us never forget that right here we have a first glimpse of the most fumdamental law of the conscious activities of mind—The Relativity of Knowledge.

This is not only a law of knowledge, but also of things. We cannot know any one thing as existing out of all relations to other things and any one thing so existing could not be known as a thing tho it might exist as a rational possibility. Relativity will be considered further in the next section.

Another thing to be remembered is this. First knowledge is always purely sensuous. Higher up in mental development it becomes more and more deliberative or intellectual. But from first to last it is always more or less closely affiliated with sense experience of our physical surroundings. Common sense is thus intimately woven into our mental being from first to last, no matter what we are, animal or man.

The necessary steps in the acquisition of the knowledge and mental culture that makes a human being, under the laws of mental evolution, may be described as follows: (1), The careful observation of things by the best use of the physical senses: (2), The retention of memories acquired by the sense-perception of things and their relations: (3), The formation of ideas about things and their relations: (4), All ideas are first formed in this way; but later, the individual may obtain the same ideas by information: (5), There are two classes of ideas; those which represent the truth about things, and those which do not, and it is very necessary to know both and to hold fast to the truth: (6), The one and only test for the truth of true ideas may be found in the careful use of the well known methods of analysis and synthesis. First, carefully distinguish things by a clear and often repeated sense of their differences; then learn their true relations by numerous and careful observations. When a large number of related things have been brought together in this way we begin to look for a general law of nature—the deeper and wider the generalization the more certain we can be of the law and the special science: (7), The final step, the goal of Scientific Philosophy; simply to first discover the true relations and general harmony among the special classes of things, as in the sciences, then to discover the true relations and general harmony of the sciences, as in philosophy.

— § III —

RELATIVITY AND GRAVITATION

It is here supposed or assumed that there are laws of nature which are as true of the universe, as they are of the most minute part of it. For examples, the laws of motion which govern the motion of inert matter, as defined by Newton, are as true of this material universe as they are of the smallest particle of inert matter. The law of relativity as defined by Hobbes, Hamilton, Mansel, Bain, Spencer, Condillac, Lodge, Fisk, and Burroughs, with a few slight amendments, is as true of all thought and all things, as it is of any small part of the same.

But what is relativity? Here is what I think about it: The *relativity* of Einstein and his followers may be true in principle; but like the truths of mathematics it cannot be applied until we know the great reality which we call the universe—until we know its actual form, construction in detail, the relations of its parts and their mode of operation. How can we estimate the holding capacity of a corn crib unles we have before us either the actual crib or a plan of its construction? And so with this universe of material and mental things. It is a great reality, as real and as enduring as anything can be, and it certainly could not exist without having space and time in which to exist.

If space and time were empty, relativity would still exist as a principle; but there would be no real relations for there would be no real things. And so with all relative things or laws of nature. In one sense of the words there are no laws of nature without nature. In another and more correct sense, the laws of nature are eternal truths, with or without nature. Real things cannot exist without space and time and all things are numbered and related. Relative things have no dimensions.

Relativity is a principle of both material things and mental things, and many eminent men have believed in it and have left on record what they thought about it. I quote a few of them:

"It is all one for a man to be always sensible of one thing, and not to be sensible at all of anything." Hobbes.

The knowledge of opposites is one: thus we cannot know what is tall without knowing what is short: we know what is virtue only as we know what is vice: the science of health is but another name for the science of disease." Hamilton.

"The very conception of consciousness in whatever mode it may be manifested necessarily implies distinction between one object and another. To be conscious is to be conscious of something: and that something can only be known as that which it is, by being distinguished from that which it is not." Mansel.

"The first, the deepest, the most fundamental experience of the human mind is relation or relativity." Bain.

"We think in relations. This is truly the form of all thought.'
Spencer.

The truth of this law is made conspicuous in the striking effects in consciousness of things which bear the relation of opposites. Consciousness is always most vivid in the presence of strong contrasts or sudden changes. Things opposite in any respect are always more conspicuous when viewed together as a single couple. Prominent among such couples we might mention nothing-something, space-matter, rest-motion, silence-sound, cold-heat, dark-light, negative-positive, less-more, small-great, crooked-straight, low-high, falling-rising, young-old, foolish-wise, drunk-sober, cowardly-brave, vice-virtue, pain-pleasure, disease-health, inertia-consciousness, death-life, and others.

But what is the most fundamental couple among all things viewed ultimately? The only writer known to me who reached a conclusion on this question was the Aberdeen Prof. of Logic, Alexander Bain. Since this is an exceedingly important question I must quote his argument in full because I do not agree with him and I do not want to be found guilty of misrepresentation.

"The highest universe of all must contain at least two things mutually explained and equally real. This remark is necessary, because a fallacy is often committed by using the forms of language where there is no longer a reality to correspond. Thus matter-mind, or more correctly extended-unextended—object-subject—signify a real couple, mutually explaining. Up to this point we are in the region of actual experience. There is a transition familiar to us, between certain states of consciousness called matter, and other states called mind; we know both by mutual contrast; while our knowledge can ascend no higher. Still language can take a flight beyond. We can in words, sum these two facts together—mind and matter, subject and object; we can even use a single term as the equivalent of this sum —Universe, Existence, Absolute; but our knowledge is not advanced by the step. There is nothing correlative to the supposed universe, existence, the absolute; nothing affirmed, when the supposed entity is denied. Matter we can conceive, because of its real opposite mind, but existence has no real opposite."

In a certain proper sense of the word 'real,' existence has no real opposite. But from the following sentence it appears that Prof. Bain did not use the word in this sense. As an object of thought, space in itself is a reality; as a substantial entity like matter, it is nothing of the kind. The Prof. continues:

"Granting for a moment that there were such a thing as non-existence, to give reality to existence, what is to prevent us from summing these two together, giving a name to the sum and insisting on the reality of this new entity, with a correlative reality, and so on without end? We must obviously stop somewhere; and the proper point is the highest couple that generalization can carry us to. This is to conform to the essential relativity or doubleness of knowledge. An absolute unity is not knowledge, but an unmeaning phrase."

Certainly no one can mistake the meaning of the above quoted words. "The highest universe of all must contain at least two things, mutually explained and equally real."

And these two equally real things are not space-matter or nothing-something, but they are matter-mind, or more correctly extended-unextend or object-subject. Prof. Bain asks: "what is to prevent us from summing these two together, (non-existence-existence) giving a name to the sum, and insisting on the reality of this new entity, with a correlative reality, and so on without end?" To this question I would answer: "common sense." The simple common sense of any person should be sufficient to keep him from the assumption that nothing can be an equal correlative with something. Non-existence may be a real nothing, but it is certainly not a real something. This nothing-something relation is the most conspicuous of all couples. It stands pre-eminent, simply because there is nothing beyond space and nothing can be in space without being something. This is to conform to the essential relativity of things and nothing and the doubleness of knowledge.

The principle of relativity involves three subordinate facts, first, difference in something, second, real things, third, the relations of real things among themselves and to nothing. These three are related in the order named above. Without difference in something there are no real things, without real things there are no real relations of real things. So the difference between the real relativity, and the relative relativity, is the same as the difference between real things and relative things.

Now, it is my firm belief that this space-matter or nothing-something relation, has been unknown to the world, or overlooked, from the earliest times to the present day; and the reason is simply the fact that the principle of relativity has never been completely understood and never applied as it might have been to the foundation truths of the universe. In book one of my system I have briefly quoted the words of twenty of the leading authorities, from Plato to William James, on this subject, but not one of them have seemed to know what space or time, in themselves, really are; and as to the whole truth about relativity, all of them seem to be equally in the dark.

Feeling convinced from the start that this is the primary law, that there is nothing deeper and that there is no limit to its application until we reach the limits of the universe, I have followed it as my chief guide thruout this work. To define any one thing is first, to describe all of its differences from other things and nothing, second, all of its relations to other things and nothing. When we have simply done this much, we then know what that thing is, to the utmost extent of possible knowledge. And when we get this far, then what? We shall have a complete definition of things—any thing or all things

I will here mention one failure to follow the leadship of this law because it has a significant bearing on the direct cause of gravitation or falling motion; in fact on all physical phenomena. I believe the great majority of the scientists of to day admit the existence of a material medium which is supposed to fill the space between the stars, planets, molecules and atoms of ponderable matter, called ether. But no scientist known to me has expressed the belief that the ether must be an atomic medium. In his book, "Modern Views of Electricity," Sir Oliver Lodge describes the ether as follows:

Page 319. "The material universe seems to consist of a perfectly continuous incompressible and inextensible medium, filling all space without interstices or breaks of continuity; not of a molecular or discrete structure, and as a whole completely at rest:" Also on page 410. "The ether is not atomic, not discontinuous; it is an absolutely continuous medium, without breaks or gaps or space of any kind in it."

From relativity it stands out as plain as any truth can stand under any law of nature, that the ether must exist as a necessary vehicle of motion and connecting medium between sensible material bodies, that in order to convey wave or current motion it must be first, a medium of inert matter—simply a necessary part of the one universal substance of all real things, second, that in order to be the vehicle of motion it must be an elastic medium of inert matter, third, that in order to be such a medium it must be an atomic medium, and fourth and last, being an elastic, atomic medium of inert matter capable of conveying motion, it must be both expansible and condensable, like any ponderable gas. All these requisites fit together in perfect harmony, forming a complete mechanical system, without a flaw or break in structure and mode of operation. And most noteworthy of all is the fact that this system is the one and only seemingly indispensable foundation for a mechanical explanation of the cause of gravitation or falling motion, electric and magnetic attraction and repulsion, chemical or molecular attraction and repulsion and a host of minor mysteries of physical science.

This system is not only mechanical thruout but it is the only one admissible under the true relativity. An ether medium as described by Lodge could be nothing less than an absolute solid, in which there are no differences, no things, no relations, nothing but a single formless mass of matter in all its interior.

The general application of the law of relativity and physical laws, in the explanation of the well-known mysteries of the physical universe, may be illustrated by a brief account of how these laws are applied in explaining the cause of gravitation.

In the illustration on page 22 (A A) is a ball of cork, first in air, then in water. The line (B B), shows the surface of a body of water. The ball in air, when free to move, will fall or move down to the surface of the water. In water, the ball when free to move, will rise or move up to the surface of the water. Science has explained, and it is now generally believed, that the upward motion of the cork in water is due to difference of pressure in and from the water, and this difference of pressure is explained as follows:

The weight of all ponderable bodies, solid, liquid or gaseous, is known to be in proportion to their density or the quantity of matter they contain. Cork is less dense than water, hence lighter than water equal volumes compared. The water exerts pressure (due to its weight,) on all sides of the cork and the pressure is equal in all directions from any point within its body; but this pressure increases with the depth from the surface as the weight of the water above increases. As an example, the weight of a cubic foot of water at the depth of one foot from the surface is about 62 lbs. At two feet twice that amount and so on. It is therefore clear that the cork must rise in water for two reasons; first, because it is lighter than water equal volumes compared; second, because the pressure of the water must be greater on the under side of the cork than on its upper side, for the reason that the under side is at greater depth from the surface. This, I believe, is the explanation now offered by science for the upward motion of the cork in water and to me it seems to be unquestionably true. But the cause of the downward motion of the cork in air is still a mystery and a very great mystery it is believed to be. Following is the explanation of the cause of gravitation which this philosophy requires.

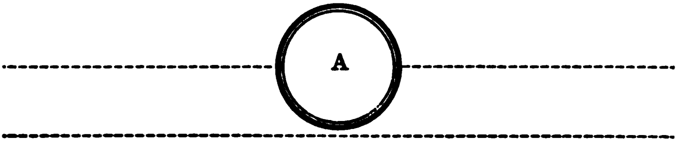
The ether must be a real material thing; which, to exist, must be in space because there is no out of space. According to this philosoply, all things (using the word things in its widest possible application) may be regarded as having three forms of existence or as belonging to three classes: first, laws of nature, of the universe, of existence: second, mental forms or ideas of laws of nature and of all other things; (the mental universe): third, forms of matter and forms of motion; (the physical universe). The ether must be a part, and a very necessary part, of the physical universe. It must be a discontinuous, expansible, compressible, atomic medium; in which the atoms must be absolutely solid and as small as possible. They must move continually, in straight lines, thru space otherwise empty, strike together and rebound, exactly as required by the laws of the motion of inert matter. Sensible motion may be communicated directly to the atoms of the ether from ponderable matter, in a number of familiar ways; by friction, heat, light, chemical action and magnetic influence. Motion thus communicated at any point will expand the medium at that point, making it proportionally more dense at other points. As a result the ether must *exert enormous* pressure in all directions from any point within its universal body. This pressure would be equal at all points and in all directions if the ether was the only body or form of matter in the universe. But a large part of the universe is composed of the atoms, molecules, and the sensible aggregates of molecules which constitute ponderable matter. Now, when motion is communicated to the ether from ponderable matter at any point, the ether is expanded at that point. This expansion will cause a difference of pressure on all ponderable bodies within the limits of the expanded field; and this difference of pressure is the direct cause of gravitation, gravity, falling motion, electric and magnetic attraction, and chemical or molecular attraction. For a more detailed explanation we will continue the case of the ball of cork first in water then in air.

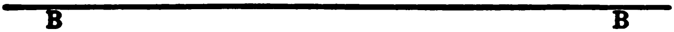
From the foregoing it may be seen that the ball of cork must fall in air for two reasons: first, because cork is more dense than air, will displace more ether and receive more pressure from the ether on its outside than air, equal volumes compared: second, the pressure of the ether (due to its atomic motion or expansive force) on the upper side of the cork must be greater than on its under side because the upper side is further from the surface of the earth, and so must receive the pressure or expansive force of a larger volume of the more expanded part of the ether. If the cork was lighter than air it would go up in air by difference of pressure from the air. If the cork was heavier than water it would go down in water by difference of pressure from the ether.

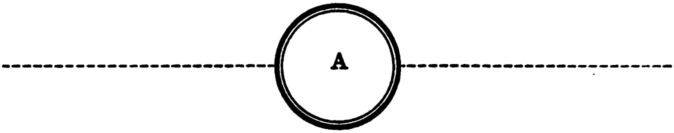
The above should be sufficient to make it plain to the lay reader that the direct pressure of the air and water which causes the sensible motion of the cork is due to superior weight, while the weight of the air and water is a direct result of the atomic motion and expansive force of the ether medium as required by Newton's laws of motion.

Gravitation or falling motion is therefore a simple result of a change of the insensible motion of the ether medium, into the sensible motion of ponderable matter; and the same physical laws which govern in this case, also govern the entire physical universe. This physical universe is the essential basis of a mental universe, both subjects of this philosophy.

THE PHILOSOPHY OF THINGS: PAGE 22

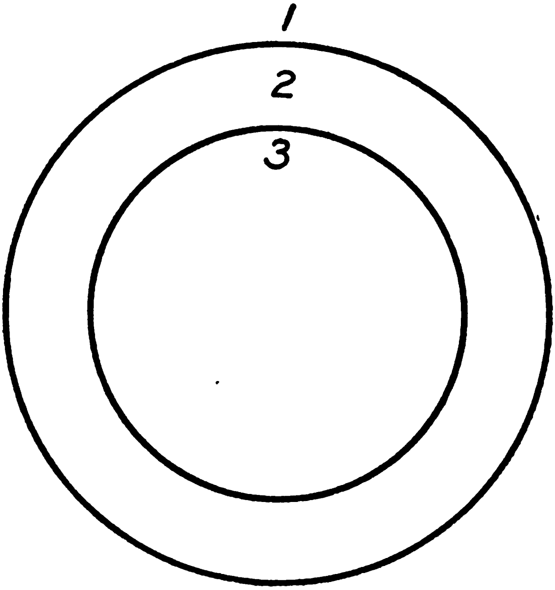






THE UNIVERSE

A TRANSVERSE SECTIONAL VIEW



1. Empty space.

2. An absolutely solid material shell.

3. A great cavity or inclosed space filled with a vast ocean of ether, in which floats the stars, planets and other bodies.

The ether is an atomic medium of inert matter, governed by the established laws of motion, and its atoms are the smallest existing particals of ordinary matter. This assumption is necessary in order to explain all mystery and unite all known facts, of both the Physical and the Mental sides of the Universe.

—§ IV—

COMMENTS AND CRITICISMS

In a number of places in this pamphlet, also in my books on this subject, I have made statements which were not sufficiently guarded or accurate to escape criticism.

On page 4 of this pamphlet I attempted in as few words as possible, to describe the meaning of a passage, on "Laws of Nature," which I find in the book "Einstein's Theories Etc" page 27. As stated I aimed to convey only my understanding of the matter but what I said has been severely criticised by the Einstein Editor. I will here reproduce in full the passages from which I quoted, also the Editor's reprimand, and let the reader judge for himself how far I am the transgressor.

Page 26-27: "LAWS OF NATURE: The observations which we have been discussing, and which we have been trying to endow with characteristics of "reality" which they are frequently not realized to possess, are the raw materials of physical science. The finished product is the result of bringing together a large number of these observations. The whole underlying thought behind the making of observations, in fact, is to correlate as many as possible of them, to obtain some generalization, and finally to express this in some simple mathematical form. This formulation is then called a "law of nature."

I found no fault in the above passage but for brevitys sake I did not quote all of it. But this author evidently regards this term as a misnomer, or to some extent inapplicable. He says:

"Much confusion exists because of a misunderstanding in the lay mind of what is meant by a "law of nature." It is perhaps not a well chosen term. One is accustomed to associate the word law with the idea of necessity or compulsion. In the realm of nature the term carries no such meaning. The laws of nature are man's imperfect attempts to explain natural phenomena; they are not inherent in matter and the universe, not an iron bar of necessity running through worlds, systems and suns. Laws of nature are little more than working hypotheses, subject to change or alteration or enlargement or even abandonment, as man's vision widens and deepens."

I quoted only as much of the above passage as seemed necessary to get the writer's meaning, and what I said about it was exactly what I thought and still think; but I did not say half as much as I ought to have said. Webster says the word "law" means "a rule prescribed by authority; a statute; a precept." In the realm of nature it means: "a formal statement of facts observed in natural phenomena."

This has always been my understanding of the meaning of this word and never before have I heard of it being questioned. Time and again I have found it true in all my daily observations. That the course of nature plainly appears in a number of uniformities, really seems to be at least one, of the most striking facts of human experience. Days and nights succeed each other in perfect order and everybody, even the animals, know it. Where is the man who does not believe that Christmas is coming, and what would our golden hopes and expectations amount to if this was a world of chance? And why are we able to enjoy the uniformities of nature and so to avoid the inconveniance of chance? Simply this: NATURE IS GOVERNED BY LAWS.

There is no other answer to this question, yet in this day and age our highest scientific authorities are actually telling us that: "in the realm of nature the term ('law') carries no such meaning."

On page 5 of this pamphlet I quoted in part the following passage on page 69 of the Einstein book.

"Einstein builds his structure on the thesis that relativity must be admitted, must be followed out to the bitter end, in spite of anything that it may do to our preconceived notions. If relativity is to be admitted at all, it must be admitted IN TOTO; no matter what else it contradicts, we have no appeal from its conclusions so long as it refrains from contradicting itself."

I ought to have quoted this passage exactly as I did here, then there would have been no complaint. But I am not worried for it gives me a chance to say more. I can tell him and the rest of the followers of Einstein that he has set forth, in the above quoted passage, a very important truth without knowing it.

It is true that figures cannot miss the mark when handled right. But Einstein builds his structure, not on real, but on relative things; and of course they must be accepted in to to, if accepted at all. To this day the world has believed that 2, and 3, and 5, make 10; but the truth is, they make nothing. Relative things are the only nothing that can be expressed by any word in our language, yet they must be something because we can think of them. In the working out of this system I am compelled to recognize the two classes of things, Real and Relative. All real things may be found in the one substance—Matter. All relative things may be known as Space, Time, Difference, Relations, Mathematics and its dranches; and these are the Laws, or Conditions, absolutely necessary to the existence of Things.

No real thing could exist without space and time, and the space-time occupying substance, in which to exist.

No relative things without real things: No laws of nature without nature. To put the truth plainer, language fails.

I sent this pamphlet to the Einstein editor before adding the four last pages and I was not a little surprised to receive an answer, and here is what he said:

233 Broadway New York November 15, 1921.

Mr. James Ferguson,
1345 Curtis Street,
Denver Colorado.

Dear Sir:—

I have your letter of October 31st, and at the same time I have found time to examine in some detail your pamphlet "The Philosophy of Things". I cannot comment upon this in full but I do wish to make the observation that if you are going to quote my book for the purpose of making adverse comments, you would do better to quote it accurately. In your quotations from my pages 27 and 69 you have reproduced not what I have said but something quite different. I judge from your failure to discriminate between the term "expressed in mathematical form", which I used, and the term "established by mathematical formula", with which you credit me, that you lack the mathematical training which is a prerequisite for complete understanding of this rather difficult topic. I think that you could have covered the ground of your objections to my book by saying just this and adding that you prefer classical science and the things that you have been taught to recognize as common sense. Lots of people are in this state of mind and it calls for no apology. As for your alleged quotation from my page

69, it is simply garbled. I have been very careful to say "If relativity is to be admitted at all, it must be admitted in to to; no matter what else it contradicts we have no appeal from its conclusions so long as it refrains from contradicting itself." You have suppressed in your quotation not merely the words which I have underlined but the very essential ideas which they convey, and you have thereby succeeded in giving to this passage a character which the original does not possess."

Faithfully yours,

J. Malcolm Bird: Einstein Prize Essay Editor.

If the reader will compare my abridged quotation on page 5 with the one in full on page 25 of this pamphlet, I believe he will be able to see that there is very little if any justification for the derogatory remarks in the last part of the letter above quoted. The gist of that passage as I see it is simply this: Einstein builds on relativity as a general principle or law of nature, which, if admitted must be admitted in toto as any general law, no matter what else it contradicts. This was my understanding of the meaning of that passage and I aimed to convey it by quoting as few words as possible. And I believe I have succeeded.

But controversy is useless. My principal reason for quoting this letter is to show the reader the present state of scientific progress and how it may be helped to move faster toward its natural goal The Philosophy of Things.

From this letter and from the book in question, it is plain that a mathematical training is believed to be a prerequisite for the complete understanding of difficult quesions of science. Since I do not possess this training I am not a capable judge of the meritorious work of Einstein, Bird, and many other transcendental mathematicians who can soar so high above human experience. But the fact remains; I am offering a common sense and scientific explanation for every one of the mysteries of the mental and physical universe. Whether true or not I feel convinced that the lay mind can understand it, and more and more I believe that the progress of physical science has been retarded by too much mathematics.

APPENDIX TO PAMPHLET No 1 PAGE 28

In my efforts to get my books before the people I have met with some difficulty, about which, it may interest the reader to know. Since 1880 I have submitted my work in Mss. or in printed proofs, to all of the leading publishers of the United States; but all have declined my offer for the reason, that the demand for books on philosophy was to small to make good profits on their sale. But a number of them offered to publish the books at my expense; I to allow them 50 per ct. of net profits. They would holesale the books to booksellers who would require at least 25 per ct. of retail price. The printing and binding of the books would cost another 25 per ct. of retail price. So in the end there would be nothing left for the author; and worse, he would have no chance to get back the cost of composing and electro-plating, which is the largest part of the expense of publication. To obtain publicity for my books in this way was out of the question, so I gave it up.

In 1910 I bought a small font of type and commenced learning to set type with the view of setting up my own work. At the present time (1922) I have the electro-plates for three books, described as follows:

BOOK I, THE PHYSICAL UNIVERSE, 12mo CLOTH, 362 PAGES.
BOOK II, THE MENTAL UNIVERSE, 12mo CLOTH, 338 PAGES.
BOOK III, TELEPATHY OR THE SPIRIT SENSE, 12mo 257 P.P.

About 200 of the pages in these books have been reset to get rid of mistakes. The total cost of type, plates, a proof press and other requisites, was at least $2,000, not including my own work. If all the work had been done in one of the regular printing plants at present prices, the total cost would have been little short of $5,000.

Thru corresponding and talking with publishers and book manufacturers, I have been told a few things which shonld be mentioned here. I quote their own words:

"To succeed, your books must be fathered by a well known publisher. Our imprint is the most valuable part of our assets."

This, an old and well known publishing house, would publish my books with their imprint on title page, and list them in their catalogues which go out to all booksellers. They would sell the books under the 50 per ct. plan, as described above and they assured me that I would make some profit if the books sold at all, but they would guarantee nothing. This was explained to me by the manager in the A. C. Mc Clurg Cos office Chicago.

Other publishers made the same offer and from their unsolicited comments on my work it appears that they were not totally blind to the merits of books which do not promise at least a safe investment. I quote from their letters

"Nov. 8th 1886. Your ms. came duly to hand and has been examined by our reader; but we regret to say that, while he does not doubt the scientific value of the work, he thinks the class of readers sufficiently interested in a discussion of this character would not be large enough to assure a profitable sale. Our experience with similar books leads us to coincide with this opinion, as it is very rarely the case indeed that they meet with more than a slight temporary demand unless their authors are well known in scientific and like circles. Under these circumstances we do not feel warranted in publishing the book on the plan you suggest, and therefore return the Ms. Thanking you for allowing us to read the work and wishing the outlook more promising we beg to remain, Yours respectfully,

J. B. Lippincott Co., Philadelphia.

This company would publish the book at my expense but I did not have the money.

"Dec. 20th 1886. Your ms. has been carefully examined by two readers, who recognsze in it a great deal to commend, but who do not think its publication a venture such as they can recommend. It may be very difficult indeed for any work on such a subject to obtain more than a very limited circulation, and so we are under due necessity of declining the work. We do this with reluctance, thanking you all the same for your offer."

Very respectfully yours, D. Appleton & Co., 1, 3 & 5
bond street New York city.

This co. did not offer to publish books on the 50 per ct. plan.

The following is a part of a letter from a Boston Co. now defunct, under date, August 20th 1894.

"I have before me the report of our reader on your Ms., and of its intrinsic merit he speaks very highly. I quote: 'It is a good, well reasoned and interesting book, reconciling, as far as I can judge, the domain of physical science with pure philosophy as the universal science of knowledge. Now, he says, if this book had been written by Kant, Spencer, Bain, Hegel or other writers of note, there would be no question as to its commercial value, but as it is and however meritorious the work, the sales could not be counted on as being very rapid, at least at first; as our reader says, it would be much more difficult to get the newspapers to notice such a book than if it were light literature. We believe your book would be what is called in the trade a stayer'; that is, sales would be slow, but would continue, and as the public became better acquainted with the book they would probably increase. I have no doubt but that it will give you much good reputation in scientific circles and would be a credit to us, but you will understand that we are to some extent in this business for at least a living return in money."

This company offered to publish the book at my expense, on the 50 per ct. plan. This seemed to be my only chance. So I sent them $350, all I had, and signed the contract. This money was to pay for the composing and plating of book one, then much smaller than at present. When the plates were ready they asked for $400, more to pay for the printing and binding of 2,000 copies. I could not raise the money. They insisted on a first edition of at least 2,000 copeis, and they offered to bear the expence, charge it to me and hold the plates and copyright as security. This was not a part of the contract so I declined the offer and asked them to send me the plates which they did.

In this venture I could see a small chance for profit, and a big chance to lose $750; and I did lose $350. It would be necessary to sell at least 5,000 book at the retail price of $1,50 each, to get back $750, the cost of publication. On this plan and number of books sold the publisher would make at least $2,000.

These are facts. The reader can judge for himself what they mean. Publishers publish books for profit, not for merit. Profit is the foundation of American industry. But there is a detter plan; better for the author and better for the reader. Be a profiiteer and cut out the publisher. See Advt. on inside of back cover.

To avoid fine, this book should be returned on
or before the date last stamped below

25M-7-42

099.9 Ferguson, J. H. 649659
F352 The philosophy of things.

NAME	DATE	NAME	DATE

649659

Stanford University Libraries
3 6105 124 458 485